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INDUSTRIAL DEVELOPMENT AND GOVERNMENT POLICIES*

THE industrial life of this country has long been on a low level and wholly unsatisfactory. What our Organization has been pleading for, for the past six years, have been privileges and concessions which all progressive Governments are accustomed to grant or provide for the orderly growth of national industries. The demands we have been putting forward are mostly such as business men freely received in countries like the Dominions of Canada and Australia. Those members of the British Commonwealth, it might be remembered, have Governments which are in complete sympathy with their respective populations. In this country too the activities of industrialists and businessmen would in all probability have borne similar fruit and they would have led to a high level of productivity and prosperity had the Government of this country not been directly opposed to the views and wishes of our business population in this matter.

PERILS FROM FURTHER NEGLECT OF INDUSTRIES

To what low level the industrial performance of our population has fallen will be understood from a comparison of the estimated average annual *per capita* production from industries which is about Rs. 15 in India and Rs. 800 to Rs. 1,000 in the two Dominions I have just named. All the facts and figures available—the retardation of industries before the war, the persistent obstruction to the automobile industry and the deliberate omission of heavy civilian industries during the war cannot lead to any other conclusion than that the present Government have been hostile to the promotion of industrial life of our country.

The result of past policies of retardation of industries has been expensive unemployment, short employment, malnutrition, chronic economic distress and at times starvation among vast masses of rural and labour population. The past policies and the present attitude of Government create a fear in the people's minds that the future of industries in this country under the present bureaucratic administration is wholly unsafe. The future is full of uncertainty and safety lies in rousing the nation to a sense of its perils by a campaign of economic preparedness undertaken by well-informed or expert public-spirited citizens in all parts of the country.

GOVERNMENT MECHANISM TO HELP INDUSTRIES

The informed public in the country has always desired that industries should be a Federal subject but Government have for their own reasons transferred the subject to Provinces under the Parliamentary Act of 1935.

* Extracts from Sir M. Visvesvaraya's Address to the First Quarterly Meeting of the Central Committee of the All-India Manufacturers' Organization, 9th June 1946.

Industries is the most important source of production and income in the Dominions, in England and in the United States of America. To relegate such a subject to the inexperienced direction of the Provincial administrations is itself proof of Government's disinclination to foster industries.

The immediate needs are—a well-equipped Industries Department at the Centre and the appointment of a full-time Minister in charge. To remove the present lack of touch between the Government and the public in this sphere an Industrial or Economic Council should be brought into existence. The Council will act as a liaison agency to bring together the Government which has the power and the industrialists and business men who have the need of the protection of that power in the interests of industrial development.

I have often recommended a grant of, say, Rs. 6 crores to be distributed among the provinces for preparing the country for industrial development, for supplying industrialists with the necessary information concerning machinery, experts, and other facilities required and for conducting the research work needed. In foreign countries like Australia, Government help industries by a permanent Tariff Board and adequate tariffs and subsidies.

Research work has been going on for four or five years but it was utilized mainly for war industries. It did not extend to any appreciable extent to civilian industries. Heavy industries, even those required for war, were kept out of the country. The establishment of the automobile industry received special discouragement and an aircraft factory started by Indian initiative was not allowed to manufacture planes. When the time for actual manufacture came, it was reduced to a repair shop.

Research work in the various Universities and Educational Institutions is going on without any appreciable direct contact with heavy industries. There is no one appointed to take stock of work done at the end of each year and to see that the money spent is being wisely used to promote industries.

General Equipment to Promote Industries

Adequate facilities are provided in every progressive country for the promotion or growth of industries. The usual equipment falls under some half a dozen heads, namely, tariff protection, subsidies, banking and finance, statistics, technical and commercial education, and travel facilities. In such countries these wants are attended to either by Government establishments or by private companies or firms, and Government give every facility in their power to supply or promote the wants as soon as they come to their notice.

No attention is paid to these wants on any system in India. A Tariff Board has been newly appointed, but it is not permanent nor has it power or specific duties to foster industrial growth as the corresponding Board in Australia for instance, is vested with. The tariffs *are not adequate to keep out unwanted foreign imports.* Until recently banking facilities were not adequate but a great development has taken place during the war period mainly through the efforts of prominent business men and groups. The want of adequate statistics has long been one of the main obstacles in the way of reliable planning and development. In the absence of statistics the country does not know where it stands. Technical and commercial education available is very limited. Travel facilities within the country are not organised. Hotels and transport facilities for trade and industry are not developed to suit the classes of people who would use them. It must be mentioned, however, that since the close of the war, Government have been giving opportunities to small deputations of leading industrialists and scientists to visit England and America. It is also pleasing to have to state here that within the past few days a *small handbook of statistical information has been issued from New Delhi.* There has been no time to assess the value of the statistics now placed at the disposal of the public but the publication itself is a welcome sign of change in the Government outlook.

Special Equipment for Immediate Needs

Industrial advance everywhere largely depended upon the sympathy of the administration and that sympathy has been lacking in the present case. It can only be supplied by a Democratic or National Government. Some time ago, our Organization put forward a few urgently needed constructive proposals for the consideration of the Government and the public. Among these were a *Technological Institute, Machinery Manufacture, Establishment of Firms of Consulting Engineers* and *Manufacture of Defence Machinery.* Several larger proposals of this description have been approved or were independently put forward by the Government of India in 1944-45.

Since they came to know that there was dissatisfaction due to the utter neglect of civilian industries in the first three years of the war, Government have established a special Planning and Development Department and appointed an Industrialist of known ability to be in charge. The Minister studied the conditions, organised the necessary staff, travelled through the country and after a visit to England and the United States of America put forward a large number of proposals and made several important promises on behalf of the Government of India. The then Secretary of State for India, Mr. L. Amery, spoke enthusiastically and practically endorsed those promises. But for some reason not known for the public the new Planning and Development Member had to quit office and although the machinery he started is allowed to continue and money is being spent, no work of a constructive character has begun. No single heavy industry of any importance which was favoured by the Member seems to have come into existence.

One of the proposals put forward by the new Planning and Development Department was the nationalization of industries. Care will have to be taken that the present capitalist system is not disturbed or summarily abandoned because in the present primitive stage of development, capitalism is likely to serve the country's purpose better than nationalization. The question of nationalization may be taken up if considered necessary after the present working

conditions are brought into conformity with the highest ideals and performances in capitalist countries.

Heavy Industries

To give training in heavy industries is a vital necessity at the present time. It needs no saying that heavy industries are of the highest value both for production of commodities and for building up armament and other Defence machinery. But these industries were retarded before the war, kept out of the country during the war, and obstacles of various kinds—many avoidable, some perhaps inevitable, are now impending progress in post-war period.

This Organization issued a small pamphlet in 1945 in which were given lists of heavy industries which business men in various parts of the country wished to see established. The manner in which it was proposed to distribute these heavy industries among the various Provinces and States was also detailed. A balanced distribution was suggested because heavy industries in the country were few and they had been very unequally distributed. Government have done nothing themselves even on this proposal. No notice has been taken of the suggestion that private entrepreneurs and industrialists who are eager to start industries should be given encouragement. The eagerness is still there but there is at the same time some hesitation and doubt that industries after they are actually started may come to grief.

There is abundant scope for the rapid establishment of key and heavy industries like steel, power, internal combustion engines, mill machinery, railway machinery and plant, automobiles, aeroplanes, dye-stuffs, drugs, and the like. Private capitalists and indigenous companies can promote many or all these industries if trust in Government policies is restored. This object would be gained if direct encouragement is given in the shape of contribution to share capital of companies, of removal of impediments when brought to notice without prolonged delays, of sanction of priority for foreign purchases, and foreign exchange. and transport of essential machinery from foreign countries.

Village Group Industrialization Scheme

A proposal for the development of lighter industries in rural areas to which this Organization attaches considerable importance is what is known as the Village Group Industrialization Scheme. This scheme deals with groups of 5 to 10 or more villages in a district, each group having an aggregate population of about 15,000. A Committee of 7 to 12 members chosen from the most competent people of the area is appointed to work for the introduction or establishment of small-scale industries.

The object of this scheme is to form village group units and train the population in each group to organize, establish or promote small-scale industries on modern business principles.

Incidentally another object is to increase the working power of the individual citizens, families or groups of citizens by giving them opportunities of working in team spirit and on the self-help principle.

A Central Village in the group will be selected to form the seat or headquarters of the committee. The committee will employ honorary workers or engage the staff necessary to instruct the rural population to establish and carry on minor or cottage industries. The scheme contemplates training the people in organization, power of initiative and self-help generally.

Now that the war is over, it should be possible to hold rural conferences under the supervision of local leaders, to draw up supplementary rules and give village group committees opportunity to develop sound village administrative practices.

There are 700,000 villages with a population of about 350 million in this country. If this scheme is efficiently and effectively worked, the prospects of village life will indeed become appreciably brighter at no distant date. After an effective start is made with industries, other developments in village reconstruction may be taken up, eventually leading to nation-building. For a clearer explanation of all that is proposed, reference is invited to the several pamphlets on the subject issued by our Organization.

Doubling Production in Five to Seven Years

On account of world changes due to progress of science and the two world wars, changes will be necessary also in the outlook and habits of the working population—more particularly in village life.

Somehow mass education was neglected in the past. Education was given only to the richer and enlightened classes. Everybody was content with that.

An enormous number of vocational and occupational schools, say, at the rate of about 50 in every district are a prime necessity. The Universities and Educational Institutions should recognise the importance of developing the *man-power resources of the country by a liberal expansion of elementary and technical education*. Also practices of increasing production and income by the use of machinery should become common. The people should be taught to work harder, to work under discipline, to utilise machinery to practise thrift and gradually develop team spirit and the habit of collective effort.

The country is quite ready for all this kind of work and training, but organization and power of initiative have been lacking. This is because even in the matter of production, Government do not see eye to eye with the people. They have their own bureaucratic methods which kill initiative and the self-help spirit. Every Village Group Committee should begin by watching progress in productivity and income (first in industries and after two or three years both in industries and agriculture) by statistical measurement. If this is done and special regard is paid to both quantity and quality of products in the two spheres, there is every prospect of production and income in the village unit area being doubled in five to seven years' time.

Practice of Storing Two Years' Food Supply

From the experience gained in Calcutta in 1943 and again in the current year in various

parts of India, it is clear that world conditions have changed and that it would be safer for our population in every area *to store sufficient food for emergencies in advance.* In former times and even now in many parts of the country food grains are stored in underground pits or large pottery or earthenware vessels. There is no reason why sufficient food supply should not be stored to *last for a couple of years.* The cost of food in normal years will be small and as a measure of self-protection the village population will learn to store food grains and to change them from year to year to keep the hoards fresh.

One of the advantages of village group unit will be that the responsibility for food storage for the future could be very appropriately taken over by the village units themselves.

The training in self-help and self-sufficiency in this manner will be of special value in preparing the enormous rural population to look after its own subsistence interests to a very material extent and lighten the burden of administration of feeding the populations in their charge in famine times. The spirit of self-help and self-sufficiency which will be acquired by such habits of prudence will be a gain of national value.

INSUFFICIENT ATTENTION PAID TO INDUSTRIAL DEVELOPMENT

From what I have stated so far two sets of inferences emerge. One is that equipment usually provided by progressive governments for promoting industries is lacking, and no signs exist that Government here were actuated by any desire to promote industries.

The second is that our Association—the A.-I.M.O.—is endeavouring, in however feeble a way it may be, to serve the cause of industries—by inducing business men to organize new factories and establishments, by persuading manufacturers and business men to work in team spirit, by advocating the liberal use of machinery and machine tools wherever it helped to economise human labour or increase production, and by rousing public interest in industries and doing whatever was possible to make the ordinary citizen industry-minded.

We are also endeavouring to bring to the knowledge of the common people the changed conditions of the business world, how safety lies in their following the post-war activities of progressive nations to the extent permitted by our resources, and how they should improve and strengthen their working power by increasing their knowledge and skill, by adopting modern business practices and resort to collective action whenever circumstances demanded.

NO COMPREHENSIVE OUTLOOK

The country is suffering from manifold deficiencies and evils among which illiteracy on a colossal scale may be said to be the most grievous. Enormous man-power which is badly needed for the country's uplift is left idle and is being wasted. The growth of population without a corresponding increase of income is another great evil. Unpreparedness for defence at a time when transfer of political power is imminent is a third. Alongside all these, comes the Government's persistent opposition to the growth of industries, particularly of the large scale or heavy type. Little attention is paid and practically no money spent on what truly constitutes the life-line of the country's business system and what ought to be treated as Government's vital and foremost responsibility.

Planning based on a study of deficiencies and wants is the best means of bringing the country's affairs into an orderly manageable shape. At present in the name of post-war reconstruction a number of schemes are being sanctioned but they were selected after consulting responsible public men interested in the developments. A few proposals like the expansion of electric power, irrigation, etc., have been approved or sanctioned, but this is being done without examining or taking into account schemes which are more urgent or important and before any unified development policy is declared in consultation with leaders who know the country's needs. The working power and employment prospects for the poorer rural and labour population are alarmingly low. The country is meeting the future unprepared.

JOURNAL OF COLLOID SCIENCE

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PREWAR Germany had secured a well-deserved leadership in the field of scientific Journalism; *Kolloid Zeitschrift* was the internationally recognised medium through which much of the specialised work in the field of colloids found adequate expression. The fate of this publication, however, is yet unknown. In the meanwhile, there has been an ever-increasing expansion of research activity in the field of colloids, both pure and applied. Colloid science has permeated and influenced newer fields of technology thanks to war-time developments in plastics, elastomeres, synthetic fibres and high polymers. A medium for the publication of developments in these expanding fields became an imperative necessity; this has found its fulfilment in the *Journal of Colloid Science,* which represents the first journal on colloid science in the English language; it is "devoted to scientific, technological and biological aspects of colloid science." The Journal has the support of an international panel of distinguished and familiar personalities in the field of colloid science and is published by Academic Press Inc., the well-known publishers of scientific literature. We share with the publishers the "hope that this publication specialising in problems of colloids and surface phenomena will make it easier for the members of the research laboratories of universities and industries to follow up developments in this field of science and to find inspiration for its application". We wish to extend to the Journal a hearty welcome and wish it a career of expanding service.

SUNSPOTS AND MONSOON RAINFALL IN INDIA

By V. SATAKOPAN, M.A.

(*Assistant Meteorologist, Meteorological Office, Poona*)

WITH the near approach of the sunspot maximum in 1948, 1949, one feels inclined to examine the claims made by earlier workers regarding the association between sunspots and rainfall with a view to find out whether a general indication of the character of the coming rainfall seasons can be had from a study of the trends in sunspot variation. The inquiry will be all the more opportune just now in respect of Indian rainfall in view of the food situation and the important bearing the coming monsoon season will have on the same. The aim of the present article is, therefore, to review the claims put forward by earlier workers with up-to-date data and to find out whether there is any justification for the claims.

Sir Gilbert Walker,[1] after correlating the annual rainfall over 154 stations over the globe with annual sunspot numbers prepared a map of the correlation coefficients and formulated the following broad conclusions:—

(1) "The general impression left by an examination of the chart may be one of disappointment at the comparative insignificance and inconsistency of the results; and it would appear from the previous section that the irregularities of local distribution are, in some cases at any rate, responsible for this. But it would appear that the coefficient of rainfall with sunspots is not in general larger than would be produced by mere chance; for among 100 stations whose rainfall may be regarded as independent the probable value of the largest coefficient is four times the probable value for a single station. It is only where the coefficients over a region have some appreciable tendency towards uniformity that a real relationship may be concluded. The relationships seem real in the case of the Nile and India; but perhaps the clearest case is South America, where below latitude 30° rainfall is deficient when sunspots are numerous."

(2) "In the case of India, for example, the correlation coefficient of sunspots with the total annual rainfall over the plains as given by all the stations in existence since 1865 to 1912 is + 0·26."

He, however, found that the correlation coefficients in respect of nine individual stations which he selected for India were very small varying between − 0·03 to + 0·19. "The natural explanation is," he says, "that the variations in solar activity affect the monsoon as a whole, but not the irregularities in the geographical distribution of the rainfall of India as a whole."

Sir Gilbert's conclusions indicate a positive relationship between sunspots and rainfall in India as a whole. According to this, years of sunspot maxima should be associated with years of abundant rainfall and sunspot minima with years of scanty rainfall.

Stetson[2] while summarising the effects of sunspots on weather as investigated by Mr. Clayton, says:—

"South America, Africa, *India* and Australia all show again 10 to 20 per cent. more rainfall during sunspot maxima than during sunspot minima."

We shall, in what follows, review the relationship between sunspots and the monsoon rainfall in India based on data of the period 1875-1945. For annual sunspots the mean annual sunspot numbers published by Wolf and Wolfer have been used supplemented by final sunspot numbers published in *Terrestrial Magnetism and Electricity* every year. For 1945, however, a provisional mean sunspot number of 38 has been assumed as no final figures are yet available. For rainfall, the departures of monsoon rainfall (June-September) for the two large divisions of "*North-West India*" and "*Peninsula*" have been considered separately. The two large divisions are the same as those used in seasonal forecasting in the India Meteorological Department. "*North-West India*" includes United Provinces West, the Punjab, Kashmir, North-West Frontier Province and Rajputana. "*Peninsula*" includes Gujarat, the Konkan, the Bombay-Deccan, Central Provinces, Hyderabad and North Madras Coast. The rainfall departure for each year is based on the data of a large number of stations recording rainfall and fairly indicates the average

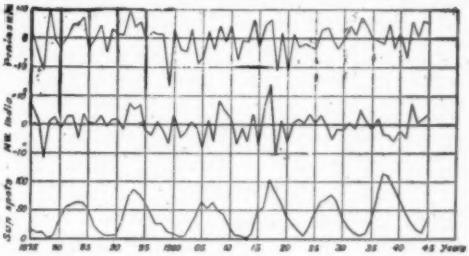

FIG. 1. Sunspots and monsoon rainfall departures

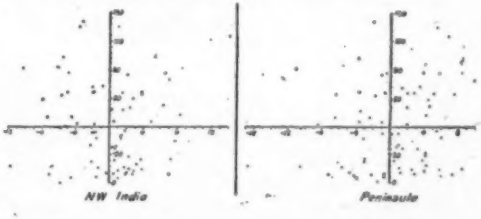

FIG. 2. Dot diagrams of sunspots and monsoon rainfall departures

rainfall condition in each year over the respective region.

Fig. 1 shows for comparison the annual sunspot numbers together with the monsoon rainfall departures in "*North-West India*" and "*Peninsula*" from 1875-1945, a period of 71 years, covering a little over six sunspot cycles. In Fig. 2 are shown the dot diagrams of sunspot numbers and the monsoon rainfall in the two forecast divisions. The points in these two

diagrams are scattered all over and do not indicate any relationship between monsoon rainfall and sunspot numbers in either of the two regions. Any linear relationship between the two elements should have been reflected in the arrangement of the points in the diagram about a line which is not the case here.

A reference to Fig. 1 would, however, indicate that there are a few coincidences such as for the years 1892, 1893, 1894, 1916 and 1917, when both sunspot numbers and rainfall have been high. Similarly the sunspot minima in the beginning of the period is associated with one year of scanty rainfall in 1877 and again in 1899 and 1901 and 1911-1913. But these coincidences stop there and curiously enough during the last two cycles there are instances of a negative relationship between sunspots and rainfall, *e.g.*, 1932, 1933, 1934 and 1935; 1942, 1943, etc.

Table I below gives the correlation coefficients between the sunspot numbers and the monsoon rainfall in *"North-West India"* and the *"Peninsula"* for each of the sunspot cycles, taken from minimum to minimum. The correlation coefficients, each being based on a very small number of degrees of freedom, are not significant but they indicate clearly the changes in the nature of association between sunspots and rainfall from cycle to cycle. There does not appear to be any consistency in the coefficients or their variation. The high coefficients in a few cases are simply the result of a random coincidence of high departure in the two elements and hence should not be interpreted as a consistent relationship.

The table also shows the correlation coefficients for the whole period 1875-1945 as well as for the two sub-periods 1875-1912 and 1913-1945.

TABLE I

Period	No. of years	Correlation coefficients of sunspot numbers with rainfall in	
		North-West India	Peninsula
1878–1888	11	+ 0·125	— 0·136
1889–1900	12	+ 0·468	+ 0·486
1901–1912	12	+ 0·095	+ 0·145
1913–1922	10	— 0·026	+ 0·231
1923–1932	10	+ 0·104	— 0·366
1933–1943	11	— 0·371	— 0·635*
1875–1912	38	+ 0·319	+ 0·226
1913–1945	33	— 0·147	— 0·163
1875–1945	71	+ 0·012	+ 0·094

*Significant at 5% level.

It is clearly seen that what appeared to be a positive relationship during the first three sunspot cycles, has changed into a slightly negative association during the recent cycles. But none of the correlation coefficients in the table is statistically significant except one.

It would, therefore, appear that there is no direct association between the occurrences of sunspot numbers and monsoon rainfall in India that will enable us to know beforehand the character of the monsoon seasons during sunspot maxima or sunspot minima. The following table which gives the average rainfall departures during epochs† of sunspot maxima and minima for the period 1875-1945 confirms this conclusion.

TABLE II (*a*)

Average rainfall departures for epochs of sunspot minima

Period	No. of years	Average rainfall departures	
		North-West India	Peninsula
1875–1880	6	— 0·1	— 0·9
1886–1891	6	+ 0·8	+ 0·8
1897–1903	7	— 1·7	— 2·4
1910–1914	5	— 1·6	+ 0·8
1921–1925	5	+ 1·4	— 2·0
1931–1935	5	+ 1·2	+ 3·4
1942–1945	4	+ 3·6	+ 4·5
	Mean:	+ 0·5*	+ 0·6*

TABLE II (*b*)

Average rainfall departures for epochs of sunspot maxima

Period	No. of years	Average rainfall departures	
		North-West India	Peninsula
1881–1885	5	+ 0·8	+ 2·7
1892–1896	5	+ 2·6	+ 4·2
1904–1909	6	— 0·1	— 1·8
1915–1920	6	— 0·3	— 1·8
1926–1930	5	— 1·1	+ 0·2
1936–1941	6	— 2·8	— 1·4
	Mean :	— 0·1*	+ 0·4*

*Roughly speaking a mean departure of ± 2 only can be considered to indicate any real effect.

The mean departures are very small and do not indicate any marked differences between years of sunspot maxima and sunspot minima.

One another point has also been tested. Whether the increasing or decreasing periods of sunspot numbers are associated with particular types of monsoon? The whole period 1875-1945 has been divided into a number of small periods when the sunspots were increasing and decreasing. The average departures of rainfall for each of these periods and for

†Epoch of sunspot maximum is taken as series of 5 or 6 years in the middle of which sunspot maximum occurs. The whole period of 1875-1945 has been divided into a series of maximum and minimum epochs as shown in Table II (*a*) and (*b*).

all similar periods put together are shown in Tables III (*a*) and III (*b*).

TABLE III (*a*)

Average rainfall departures for periods of increasing sunspot numbers

Period	No. of years	Average rainfall departures	
		North West India	Peninsula
1	2	3	4
1878–1883	6	+ 0·4	+ 2·7
1890–1894	5	+ 3·8	+ 4·4
1901–1906	6	− 2·5	− 2·9
1913–1917	5	+ 2·2	+ 3·2
1923–1928	6	+ 0·5	− 0·5
1934–1938	5	− 1·0	+ 1·3
	Mean:	+ 0·6*	+ 1·4*

It is, therefore, concluded that the apparent positive association observed between sunspot numbers and rainfall in India by Walker and others has not been maintained during recent sunspot cycles. The association between sunspot numbers and Indian rainfall is not consistent from cycle to cycle of sunspot variation and hence it is not possible to judge the character of rainfall seasons from the trend of sunspot variation.

TABLE III (*b*)

Average rainfall departure for periods of decreasing sunspot numbers

1	2	3	4
1884–1889	6	+ 1·5	+ 1·1
1895–1900	6	− 1·8	− 1·8
1907–1912	6	+ 0·2	− 0·3
1918–1922	5	− 2·5	− 4·2
1929–1933	5	+ 0·6	+ 1·6
1939–1944	6	− 0·2	+ 0·6
	Mean:	− 0·4*	− 0·5*

*Roughly only average departures over ± 2·0 will be significant.

1. Walker, *Mem. Ind. Met. Dept.*, **21**, Pt. 10. 2. Stetson, *Sunspots and Their Effects*, Ch. VII.

Note.—The cost of printing this contribution has been defrayed by a generous grant from the Rockefeller Foundation for the publication of results of scientific work made to us through the kindness of the National Institute of Sciences, India.—*Ed.*

THE BELLARA GOLD MINE

By B. RAMA RAO

(*Director of Geology, Government of Mysore, Bangalore*)

Situation.—The Bellara Gold Mining block, situated about 95 miles N.W. of Bangalore, lies amidst a thickly wooded deciduous forest covered with Kamara trees (*Hardwickia binata*). It is a mile and a half to the E.N.E. of Bellara, a road-side village, 19 miles to the west of Sira, in the Sira-Huliyar road, in the Tumkur district. Actually the mine is about a mile north of the forty-third milestone in this road and can be reached easily from that spot through a connecting road which has been recently constructed.

The auriferous formation of this region consists of a massive basic igneous rock (locally called grey trap)—bouldery for the most part or somewhat crushed and rudely schisted at places—penetrated by several quartz reefs of various dimensions exposed here and there as disconnected runs. Most of these reefs are found to be gold bearing.

Early History.—The gold-bearing reefs of this area, as in all the other auriferous tracts in Mysore, had been worked to some extent by ancient miners. In 1897 or 1898, the State Geological Department discovered in this region some of those ancient workings. About the same time, one Mr. R. H. Morris, finding a few more of such workings, obtained a license over an area of 9 square miles to prospect for gold. He transferred his interest, soon after, to the Indian Mines Development Syndicate, Ltd., who took over the license from him on option and conducted, in the early years of this century, some extensive underground investigations on two of the most promising reefs in the region.

Commencing their work in 1902 on the eastern reef, exposed prominently on the slope of a small hill, S.W. of Δ 2567, this Syndicate sunk three shafts to various depths and had driven levels at depths of 130, 230 and 330 feet from the surface. After considerable exploration of this reef, which they called the Bellara reef, the work was discontinued, however, at the end of 1905.

At the foot of the the hill, about 1¼ furlongs west of this reef, another reef was located by the Syndicate after a considerable amount of exploration and prospecting. On this reef, which they styled "Tank Reef", ten shafts were sunk altogether over a length of some 2,000 feet, six of the shafts being in a line north and south, and the rest on the sides parallel to them. The shafts were sunk to varying depths, the deepest being a little more than 400 feet. Several levels had been driven at various intervals, to varying distances, from the different shafts and also a few winzes connecting the different levels.

These extensive operations, conducted over some four or 5 years, had disclosed that the western reef (Tank Reef) varied in width from 2 or 3 inches to 2½ feet and in gold value from a mere trace to about 3 ounces per ton with occasional richer shoots. It had been estimated that a few thousand tons of quartz

could be taken out from this reef at an average of 9 dwts. per ton; but still the total tonnage of such quartz was considered insufficient for large-scale operations and the gold value of the reef in depth, at some of the spots tested, was also considered too poor to tempt further extensive explorations beyond. Hence, the Syndicate abandoned the mine, finally, after several years of trial.

A couple of hundred tons of quartz which had been taken out during the course of these operations had been left stacked at the shaft-heads, being considered perhaps as unprofitable for treatment. Some of the local people who were aware of the existence of this gold quartz, took advantage of the situation of the stacks in the midst of the jungle far from any inhabited villages and started extracting gold surreptitiously. We are not quite sure for how long this clandestine practice was carried on, but the culprits were caught, however, red-handed in January 1941. The concentrates recovered from them on assaying in the chemical laboratory of the Geological Department, indicated very rich values, varying from 90 to 500 ounces of gold per ton. Since it was more or less impracticable to prevent altogether such unlawful, underhand, extractions by ordinary vigilance in that forest-covered area, the Geological Department took up in 1943, the extraction of gold by washing the powdered pieces of good-looking quartz, and also the mine debris and soil nearby, in specially constructed washing cradles.

While this work was going on it came to the notice of the Mysore Government that a small section of the workings on the Tank Reef contains a fairly rich zone which was believed to yield about 2,000 tons of auriferous quartz of an average grade of 11 dwts. per ton. On the strength of this information, and after a careful consideration of all aspects, the Government of Mysore decided to have the area thoroughly investigated. In May 1944, they sanctioned the proposal of the Director of Geology to recover the available gold from this known reserve of 2,000 tons of auriferous quartz at an estimated initial cost of Rs. 1·70 lakhs, and also to conduct further large-scale intensive investigations on the reef to ascertain its suitability or otherwise for commercial exploitation.

Present Operations.—The work of the Indian Mines Development Syndicate had indicated that the Tank Reef formed a thin vein of auriferous quartz of an average width of about 2 feet, traceable for a length of over 2,000 feet north and south. The reef with a pronounced westerly dip seems to have been followed on its underlie for over 400 feet in depth, beyond which it had not been traced. For the present operations which commenced in July 1944, almost the central portion of the reef was selected. In accordance with the sanctioned programme for extracting the gold from the proved reserve of 2,000 tons of quartz in this selected portion, the Geological Department started its operations with the cleaning and reconditioning of three of the old shafts which the Indian Mines Development Syndicate had sunk in this section and which, from disuse, had all collapsed and partially filled up with debris. The work done so far since the commencement has resulted in thoroughly renovating these three shafts to depths of 100 to 150 feet, and also the 100-foot level, where the reef had been first met with underground, to about 350 feet north and south and the 150-foot level lower down, to 600 feet. The portions reconditioned expose the auriferous reef right through. The eastern extension of the reef from the 100-foot level is being traced by driving in that direction, and though the reef has been followed till now to about 150 feet it seems to be continuing still further. The present development of the reef so far has exposed and blocked for stoping about 4,000 tons of quartz of an average estimated yield of about 10 dwts. of gold per ton. A few thin splashes and pockets of considerably richer portions are being occasionally met with, which may tend to raise the estimated average yield somewhat higher. From one of such exceptionally rich pockets recently struck, which may not yield more than a ton or two of very rich quartz, by hand-pounding some 2 or 3 panfuls nearly 100 ounces of fine gold have already been obtained, and another 80 to 100 ounces of gold will easily be won from the remaining portion.

The extent of the reef to be mined and treated at present, being nearly twice of what had been at first proposed, the revised scheme as now stands is estimated to cost about Rs. 3·9 lakhs. From the portion of the reef now developed about 1,200 tons of auriferous quartz have already been mined and stacked at the surface ready for treatment and the remaining 3,000 tons are under stoping. It is anticipated that these 4,000 tons of auriferous quartz will yield at least some 2,000 ounces of gold worth, at the present market value, about Rs. 4¼ to 4½ lakhs.

There has been a considerable delay in getting the needed machinery and other appliances. Consequently, the milling and extraction of gold have not been started as yet. However, from washing the debris in the mined areas and from hand-pounding small pieces of rich quartz about 120 ounces (250 tolas), valued at Rs. 26,000-27,000, at the present market rates, have been recovered; and another 80 to 100 ounces are anticipated to be recovered during this month and the next.

Future Prospects.—The previous work of the Indian Mines Development Syndicate indicates that the Tank Reef runs north and south for a length of at least 2,000 feet and would yield some 80,000 to 100,000 tons of quartz to a depth of about 400 feet from the surface. The reef had not been traced beyond that depth since it seems to have got poorer in its gold value at that depth. Consequently, it is not known precisely how deep the reef would go, and what would be its width and value beyond the explored depth of 400 ft. The central section of the reef as now developed shows, however, that in this zone it forms, more or less, a gently undulating, tabular vein, of an average thickness of 1½ to 2½ feet, faulted and cut off abruptly at the 150-foot level. The previous workers seem to have followed downwards the thin stringer of quartz which occupies the fault line at 150-foot level. Very probably this may be a separate reef,—a later vein filling up the fault fissure, which, widening out below, might have shown low values in gold. If so, the continuation of the dislo-

cated richer reef, west of the fault line, remains yet to be discovered and traced.

The work done so far has not yet reached beyond the investigatory stage and as such it is too early to foresee whether the area will develop into a large productive mine. If, as we surmise, the previous workers had lost at the fault zone the rich shoot we are developing now and had followed in depth a much poorer reef; and if the dislocated portion of the rich shoot could be discovered and traced west of the fault zone, there is every likelihood of the area developing into a fair-sized productive mine. There are a few other auriferous reefs in the area, including the Bellara Reef, which would add considerably to the tonnage of quartz suitable for milling. Consequently, the prospects so far as one can foresee at present seem to be quite encouraging, and there is every reason to hope that the region will turn out into a thriving gold field though, perhaps, on a considerably smaller scale than the well-known Kolar Gold Field.

Geological Department,
Bangalore,
May 12, 1946.

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THE UTILISATION OF BY-PRODUCTS OF THE SHARK LIVER OIL INDUSTRY

BY

B. B. DEY, M. GIRIRAJ, V. SRINIVASAN AND (MISS) MEERA DEY

(Department of Chemistry, Presidency College, Madras)

THERE has been considerable development of late of shark fishing in the coastal waters of India on account of the shark liver oil industry which received impetus during the war from the recognition of the oil as one of the richest sources of vitamin A. The shark liver oil industry has been established in different parts on the west and east coasts (Bombay, Calicut, Travancore, Madras and other parts) and has already made promising headway. The Madras Government Department of Fisheries have started deep-sea shark-fishing and sharks are now landed on the Madras coast regularly. These belong chiefly to the species of the genera, *viz.*, *Scoliodon*, *Galeocerdo* and *Carcharias*. The survival of the industry during the post-war foreign competition should be a matter of vital concern to this country and would largely depend on the measures taken by the Central Government for the protection of the industry and for the prosecution of fundamental researches on the scientific and technical aspects. The urgent need for research on the commercial utilisation of the waste products of the industry has been appreciated by the Council of Scientific and Industrial Research which has provided funds for the investigation of shark waste and their utilisation in the chemical laboratories of the Presidency College, Madras. Gajjar and Sreenivasaya[1] in their recent communication on this subject have rightly laid stress on the national importance of the shark liver oil industry and have also presented certain data regarding the various organs and tissues of sharks which may be economically utilised as by-products of this industry. These data appear, however, to differ in many important respects from the figures obtained by us from sharks landed on the Madras coast. The sharks available on the Madras coast rarely exceed 600 lbs. in weight and the livers constitute nearly 25 per cent. of the total body weight. The only exceptions to this have been met with in the case of pregnant sharks with well-developed embryos which have been found to weigh sometimes as much as 900 lbs. The average weight of the sharks referred to by Gajjar and Sreenivasaya on the other hand, appears to be as high as 1,500 lbs. and the weight of the liver is stated to be only 3·3 per cent. of the body (*loc. cit.*). These differences are probably due to a difference in the species of sharks dealt with, as the previous authors have not specified the families of sharks from which their data pertaining to the relative weights of the various organs and tissues have been derived. We consider it useful, therefore, to present briefly a few details of the accurate figures obtained in the course of our work regarding some of the sharks caught on the Madras coast.

The commonest variety of sharks caught in this area is the *Galeocerdo tigrinus*. Sharks of this species measure from 100-150 inches in length and weigh from 300-600 lbs., and the livers constitute 20 to 28 per cent. of the weight of the whole fish. The relative proportions of the various parts of six typical specimens of these sharks are given in Table I and the average percentage weights of the different parts of seven sharks of the same species

TABLE I

(All weighings from fresh material expressed in lbs.)

No.	Length (inches)	Total wt.	Liver	Head & other cartileges	Hide	Fins	Stomach & Intestines	Blood	Muscle & other organs
1	114	316	70	65	63	12	15	3	88
2	114	290	70	60	61	9	15	3	72
3	140	507	115	110	70	15	25	3·6	168·4
4	145	507	127	104	64	15	26	4	167
5	145	545	150	118	73	14	29	4	157
6*	145	726	192	112	71	15	169	3	160

* A female shark with 38 embryos.

having an approximate length of 140 inches each is given in Table II.

TABLE II

Percentage proportions of fresh animal

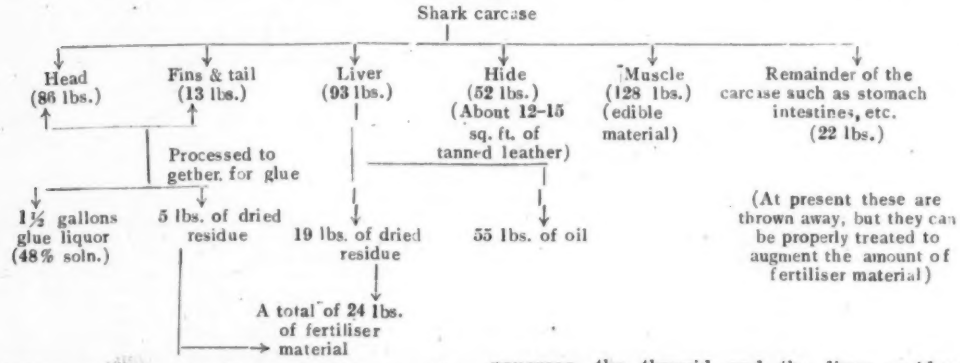
	Per cent.
Liver	.. 23·3
Head and skeletal cartilage	.. 21·5
Hide	.. 13·8
Fins and tail	.. 3·2
Heart, stomach, gills, intestines, etc.	.. 5·7
Blood	.. 0·8
Muscle, etc.	.. 31·7

Sharks of the *Carcharias* variety which form about 20 per cent. of the sharks landed on the Madras coast are smaller, measuring on the average 80-90 inches in length, and weighing approximately 230 lbs. The average weight of the liver in these animals does not exceed 26 lbs., i.e., approximately 11 per cent. of the total weight of the animal. The yield of the oil in both these species is, however, nearly the same, *viz.*, 55-65 per cent. of the weight of the liver.

The following table showing the amounts of the main products which may be obtained from a shark weighing 400 lbs. is based on the results of the preliminary work which has been carried out so far in these laboratories.

It will be evident from the table that from a shark of average weight of the *Galeocerdo tigrinus* species it would be possible to obtain 55 lbs. of liver oil rich in vitamin A, about 15 sq. feet of tanned leather, 128 lbs. (fresh weight) of edible flesh which may be filleted and smoked, 1½ gallons of good glue liquor containing 5-6 lbs. of solid matter and 24-30 lbs. of dry material of high calcium, phosphorus and nitrogen content suitable for use as fertiliser apart from the hormones of the pancreas, the thyroid and the liver residues on which work is in progress.

TABLE III


Shark carcase
Head (86 lbs.)
Fins & tail (13 lbs.)
Liver (93 lbs.)
Hide (52 lbs.) (About 12-15 sq. ft. of tanned leather)
Muscle (128 lbs.) (edible material)
Remainder of the carcase such as stomach intestines, etc. (22 lbs.)
Processed together for glue
1½ gallons glue liquor (48% soln.)
5 lbs. of dried residue
19 lbs. of dried residue
55 lbs. of oil
(At present these are thrown away, but they can be properly treated to augment the amount of fertiliser material)
A total of 24 lbs. of fertiliser material

This investigation has been carried out with a grant provided by the Council of Scientific and Industrial Research to whom our thanks are due. We are also thankful to the Deep-Sea Fishing Department, Madras, for their co-operation during the course of this investigation.

1. Gajjar and Sreenivasaya, *Curr. Sci.*, 1945, **14**, 220.

THE URGE FOR WHOLENESS*

WHAT is the most basic urge or trend of human nature? Contemporary psychology gives many answers; sex, will or power, behaviour, reflex action, purpose and some other similar concepts. The variety of voices of these answers, so different and exclusive as they are, constitute the well-known crisis in the science of psychology to-day.

The question, What is really the first or fundamental urge of human nature, therefore, becomes an acute issue.

The author of this address would contend that an answer to this question can only be formulated by considering the whole phenomena of human nature in all its ranges of experience, conscious, subconscious and the super-conscious. Most of the existing answers are based upon an exclusive consideration of the nature of the subconscious or a bit of bodily behaviour or some other particular fact. The super-conscious experience testified to by vast yogic, mystic and religious literature of the world and the modern yogic practice have so far not been seriously considered by the psychologist in evolving his view of human nature. And while evolution is recognised as a fact we do not seem fully to recognise that for the understanding and explaining of a particular stage of the process the stages antecedent to it alone cannot be sufficient. McDougall affirmed "purpose" or "goal seeking" as the essential characteristic of mind, but yet resorted to searching for the antecedent facts of "structural dispositions" to explain instinctive behaviour. The natural science habit of looking for antecedents as causes seems to have influenced unconsciously even a deliberate purposivist like him.

* A popular summary of Dr. Indra Sen's Presidential Address to the Section of Psychology and Educational Science, Indian Science Congresss, Bangalore, 1946.

Indian psychology, in the opinion of the author, has been thoroughly purposivistic. To it the next higher form of consciousness possible to man has been the matter of the first importance. The end towards which an evolutionary process moves is by far the most important single factor to explain the nature of the process. The antecedents come only next to it. Indian psychology discovered and ascertained the reality of a form of consciousness, possessed of the quality of wholeness, a consciousness in which knowing, feeling and willing operate not through mutual stresses and strains and an economic balance of the whole, but through an essential unity and harmony. If such a consciousness is a reality then obviously our present view of mental action needs a radical re-orientation.

The author feels strongly persuaded to affirm that an evolving "wholeness—a tendency to a progressive perfection of organisation—is the principal trend not only of human nature but of organic evolution as a whole. This progressive perfection of organisation of life is more easily noticeable in the sub-human species, from amœba to the ape, in an increasing adaptation to and mastery of, an ever more complex environment on the whole. In man, however, the situation becomes changed. Through his power of thought he rises to an immensely greater capacity of dealing with his environment. But through the development of self-consciousness, which makes thinking possible, he becomes conscious of deep inner discords whose harmonisation becomes the new direction of evolution. Simultaneously he becomes conscious of the mechanism of projection, as a fact ingrained in his animal nature, and begins to recognise the true causes of happenings as belonging to the forces within the personality rather than to things outside. Now the yogic fact of a fulfilled consciousness, a consciousness, whole, harmonious and balanced, called by Sri Aurobindo the Psychic Consciousness, experienced and enjoyed by many individuals in the past (to that the yogic, mystic and religious literature bears wide evidence) and which to-day is equally well experienceable by pursuing an intensive inner discipline of life, comes closely in line with the fact of general human consciousness. The fact, no doubt, occurs under rather exacting conditions of life, but when once its character is definitely ascertained, its effects for general consciousness, which are tremendous, will become easier to determine. But even otherwise the quality of the fact, so distinct and unique, representing a form of consciousness, in which the so-called fundamental polarities and dualities of the general human consciousness are made good, must irresistibly draw our attention. Further the fact coming as it does in the wake of the divided general human consciousness, obviously becomes the more powerful single consideration in support of the hypothesis that human nature as also organised evolution generally present a picture of a self-evolving wholeness. In other words, what is basic to human nature and towards which it is tending is a form and status of fully organised consciousness in which its present polarities are harmonised and reconciled. But this tendency to wholeness appears to be marked by the experimental procedure, so that within the framework of general progression it becomes possible for individual men or species in the sub-human level to show signs of fixation, regression or any other form of deviation from the normal behaviour.

Among contemporary psychologists, it is interesting, we discover many direct and indirect recognition of the fact of a whole and a harmonised consciousness. Even in Freud, who picked up polarities after polarities in human nature and made most of them ultimate to human nature, we read such a sentence as this: "It can be easily imagined that certain practices of mystics may succeed in upsetting the normal relation between the different regions of the mind, so that for example, the perceptual system becomes able to grasp relations in the deeper layers of the ego and in the id, which would be otherwise inaccessible to it." Dr. Bose, the most eminent psychoanalyst of our country, while carrying the idea of polarity to the extent of posting a counter-wish to every wish, affirms himself to be a believer in "pure consciousness as distinguished from consciousness of this or that." Further in his theory of mind he finds it necessary to admit a principle of unity as the "guiding principle" of all mental action. This principle according to him, reconciles the last polarity of subject and object.

Dr. Mitra's hypothesis regarding the nature of mind possesses an obvious similarity to the view here defended, as he assumes that mind, to start with, is "in a state of perfectly stable equilibrium quite content and at harmony with itself. However, for us, such equilibrium is the evolutional goal, not the starting point.

McDougall too contemplates a fully integrated personality under a single master sentiment.

However Jung stands above all in having perceived clearly and distinctly the force and the power of the psychic consciousness. He finds the ordinary psychological explanation of personality as "inappropriate" and guided by his principles of analytical psychology discovers a truly unique fact in personality. This he calls, the "centre" or "self". To activate the centre and live in the consciousness of the self is to live the life of wholeness. This consciousness is creatively synthetic, as it assimilates the disparate materials of our mental nature and reshapes them into the picture of wholeness. All this perception is superb. Yogic practice too, at its best, aims at nothing else but the activation of the psychic centre or the soul in its dynamic aspect.

But while the recognition of a unique centre is fine, Jung did not see that the consciousness of the centre, marked by a sense of wholeness, constitutes a higher plane than the ordinary mental consciousness. In consequence he mixed up the super-conscious with the sub-conscious and declared the *Samadhi* state a state of unconsciousness.

The hypothesis here presented thus commands an appreciable direct and indirect support from contemporary psychology. But it

primarily relies upon its own strength and merit. It offers a theory of mind based upon the widest data of conscious phenomena, since it takes into consideration the evolutional progress as a whole from the earliest beginnings to the stages, which yet set the goal to the present human consciousness. It gives a coherent explanation of the normal and the abnormal consciousness. Above all, it gives a clear scientific meaning to the concept "normal" and saves the term from being a changing social average. Lastly, affording a fuller perspective of mental life, it is capable of reconciling the conflicting standpoints of the schools of contemporary psychology. The fact of psychic consciousness is a supreme fact for psychology as it presents a form of consciousness higher than the mental and is, therefore, capable of showing the true sphere of validity of the terms of our ordinary consciousness. Sex, will power, etc., cease to have the validity they ordinarily possess for the psychic consciousness. The urge for wholeness, the trend towards a fuller organisation and harmony of life, as shown by the psychic consciousness, therefore, is the most basic trend of human nature. The other answers, possessing a partial validity as they do, can be accommodated as particular instrumentations of the trend towards wholeness.

Indian psychology has indeed a great promise but the value of its peculiar standpoint and the facts discovered by it have yet to be appraised by us for the benefit of our modern psychological knowledge.

SOYA BEAN*

SOYA BEAN as a foodstuff holding high promise has received wide attention in India, but mostly at the hands of well meaning social workers imbued with more spirit than knowledge. To them soya bean appeared to be the panacea for all evils in India arising out of underfeeding and malnourishment. They have been encouraged in this belief by a certain section of scientific workers who took every article published in scientific, semi-scientific or popular journals outside India as gospel truth.

Soya bean was already an established article of diet in China and some other countries of the Far East before its introduction to Europe and America. The Americans have been particularly responsible for bringing its nutritive value to the notice of the rest of the world during recent years. Its high protein and fat content formed the bedrock on which nutritive value of soya bean was based. It was naturally thought that the deficiencies of Indian dietaries could be made good by soya bean. Humanitarian enthusiasts have tried to bring its good points before the public and the authorities with a view to initiating and encouraging cultivation and popularisation of the soya bean in India.

Although some varieties of soya bean grow along the northern border of India, it cannot strictly be called indigenous in the sense that the pulses and other beans are. Sporadic attempts have been made to grow it as a food (or cash) crop in India. The Agricultural Department of the Government of India also had to consider whether the production of soya bean in this country deserved encouragement for purposes of human consumption.

In the meantime soya bean was engaging the attention of scientific workers in this country. Unfortunately there were two irreconcilable schools of thought holding divergent views. In 1941 the Nutrition Advisory Committee of the Indian Research Fund Association (which is also the National Nutrition Advisory Committee with the Government of India) finding itself unable to compose the differences by discussion across the table appointed a Sub-Committee consisting of Dr. W. R. Aykroyd, Dr. K. P. Basu, Prof. B. C. Guha, Dr. V. N. Patwardhan and Dr. K. C. K. E. Raja, to suggest lines on which further experiments on soya bean might be carried out by different laboratories, with a view to provide an answer to the question, "Whether the nutritive value of soya bean in comparison with those of common Indian pulses is such as to justify from the standpoint of human nutrition, the encouragement of the production and consumption of soya bean on a wide scale in India".

The results of the co-ordinated investigations carried out in the four laboratories at Bombay, Coonoor, Dacca and Lahore under the auspices of the Sub-Committee have recently been published as a Special Report (I.R.F.A. No. 13). The investigations mainly dealt with (*a*) the biological value of soya bean and pulse proteins, (*b*) the effect of heat treatment on the nutritive value and (*c*) the supplementary value of soya bean and pulses to the so-called poor *Madrasi diet*. Although most of the work was done on albino rats some experiments on human beings were conducted as well. An account of most of the earlier work on soya bean has also been included in the report.

The biological value and digestibility coefficient of the soya bean protein by growth and metabolic studies on albino rats and in human beings were found to be of the same order as those of the other pulses. In spite of its high available protein content (1½ to 2 times that of pulses) soya bean did not prove any better than the common Indian pulses as a supplement to the poor rice diet. In most experiments Bengal gram seems to have given better results than even soya bean. Incidentally it has been found that the so-called "poor Madrasi" diet suffers more from a lack of minerals and vitamins than from that of proteins.

After four years of work the Soya Bean Sub-Committee came to the conclusion "that as a supplement to typical Indian diets based on

* "Report on Soya Bean," by the Soya Bean Sub-Committee of the Nutrition Advisory Committee, Indian Research Fund Association, Jan. 1946, p. 35, Price As. 8 only.

cereals, but supplied in adequate quantity, soya bean has no special advantage over common Indian pulses". Finally the Sub-Committee states that "it is not in a position, therefore, to advocate *immediately* the encouragement of the production of soya bean on a wide scale in India for use as a substitute for Indian pulses".

One point connected with soya bean, however, would appear to need further consideration; it pertains to what is known as "synthetic" milk. One of the methods of processing soya bean for human consumption is to prepare a milk-like fluid from it. Soya bean is softened by steeping for varying periods in warm water and is then ground with further addition of water. When coarse particles are removed by sieving an emulsified fluid is left behind. The emulsion thus obtained looks like milk and in composition varies according to (*a*) the method of preparation and (*b*) the quantity of water added. For ages, "soya milk" thus prepared has been used in China; the main reason for its extensive use in certain regions in China is the almost complete absence of cow's milk from the prevalent human dietary. The soya emulsion prepared as above is inferior even after fortification with salts and vitamins in nutritive value as compared with fresh whole milk. There could be no doubt that an emulsion from the germinated bean would give a preparation with a greater nutritive value as compared with that obtained from untreated beans. There is little proof, however, to show that it approaches cow's milk, although it may appear to be so by virtue of its chemical composition; this is a crude way of comparing two biologicals. The I.R.F.A. Report makes it clear that all the available evidence points to the conclusion "that soya bean preparations, if fed to infants, need to be supplemented by minerals and vitamins and that even after such supplementation they are less satisfactory than breast milk or cow's milk".

The only acceptable proof of the value of soya emulsion in human nutrition should be forthcoming from suitably designed and rigorously controlled experiments on human beings. Conclusions based on other considerations, such as chemical composition, effects on experimental animals, etc., would still fail to provide the decisive proof which is absolutely essential if the question is to be settled to the satisfaction of all.

The Indian Research Fund Association deserve to be congratulated not only for providing an authoritative report on the vexed question of soya bean, but also for demonstrating an effective way through which controversial issues in the field of scientific endeavour could be authoritatively settled.

NATIONAL AIRCRAFT INDUSTRY FOR INDIA

THE Government of India have decided to establish a National Aircraft Industry in India, with a 20-year target of complete self-sufficiency, for building aircraft needed for the Royal Indian Air Force as well as for civil aviation. The decision is based on the recommendation of the United Kingdom Aircraft Mission which was invited to India in March 1946. The report will be released as soon as arrangements for its printing can be made.

The Mission consisted of Messrs. J. V. Connolly and L. R. Barrett from H.M.G.'s Ministry of Supply and Aircraft Production and Messrs. J. D. North and S. P. Woodley of the Society of British Aircraft Constructors. Arriving in India on March 25, they made a rapid, but intensive survey of the potentialities for the manufacture of aircraft and its ancillary products. They visited the aircraft repair and maintenance factories at Barrackpore, Poona and Bangalore as well as the Ordnance factories at Cawnpore, Cossipore and Jubbulpore.

After examining the three sites at which aircraft repair and maintenance had been carried on during the war—at Barrackpore, Poona and Bangalore—the Mission recommended that aircraft production should, initially, be started in the Bangalore factory, as it is the only one which is still a working aircraft unit, has the longest experience of aircraft work and the greatest number of staff and operatives experienced in working as a team on aircraft production. It has to its credit the design, execution and successful flight of an entirely original prototype glider. Moreover, research and training facilities are available closeby at the Indian Institute of Science at Bangalore.

Due to the comparatively small initial demand for aircraft, only one factory is recommended in the first instance; but at a later stage of development, production may be started at other centres.

The Mission attach particular importance even at the initial stage to the designing of aircraft, as only by this means will the necessary confidence and skill be obtained by Indian staff. The Government have accordingly decided that the design of an original prototype aeroplane specifically suited to Indian conditions should be taken up immediately.

The Mission have given a detailed report on some aspect of technical training including that available at the Indian Institute of Science, Bangalore; and also on labour training. They consider the facilities available at Bangalore promising and have suggested ways and means for their development and co-ordination with the requirements of the industry.

The Government have decided that steps should be taken forthwith for the production of trainer aircraft required for the R.I.A.F. It is anticipated that the first aircraft will come out of the Indian factory in less than 18 months from now.

The size of Hindustan Aircraft Ltd. makes some complementary manufacture side by side with aircraft production desirable during the first quinquennium. The passenger coach project has been recommended as eminently suitable by the Mission. The Railway Department are prepared to place orders for coaches for the next five years subject to the type and price being found satisfactory. Their first order will be for 100 coaches, which is understood to be the maximum yearly capacity of the factory.

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A NEW CATALYTIC REACTION IN THE VAPOUR PHASE: ALLYL ALCOHOL FROM GLYCERINE

IN the course of our investigations in the vapour phase catalytic decomposition of glycerine, the formation of allyl alcohol in good yields in a single stage conversion was observed in a reducing atmosphere, the other products being polyglycerol and water.

The decomposition of glycerine has been studied by Sabatier and others[1,2,3] over dehydration catalysts. Sabatier observed acrolein, polyglycerols and gases during decomposition over Al_2O_3 and anhydrous $MgSO_4$, etc., at 360° C. In Sabatier's study of glycerine decomposition over copper powder[4] at 330° C., traces of allyl and ethyl alcohols were reported to have been obtained.

The well-known preparation of allyl alcohol from glycerine and oxalic or formic acid was first described by Chattaway.[5] The oxalic or formic acid reacts with glycerine to form the monoformin, which is next decomposed into allyl alcohol with 45 per cent. yields of alcohol on glycerine used. Since the acids are lost due to reaction, the method is prohibitive in cost. The commercial processes for manufacture of allyl alcohol utilise propylene from natural gas. In a new Shell Development Company's process[6] propylene is selectively chlorinated to allyl chloride which is subsequently hydrolysed to allyl alcohol:

$$CH_2 = CH - CH_3 + Cl_2 \longrightarrow CH_2 = CH - CH_2 - Cl + HCl.$$

$$CH_2 = CH - CH_2 - Cl + NaOH \longrightarrow CH_2 = CH_2 - OH + NaCl.$$

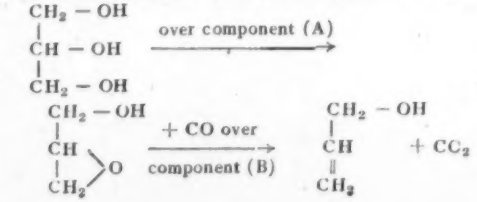
Another patent[7] describes the oxidation of propylene to propylene oxide, the epoxide in turn being isomerised into allyl alcohol over alum catalyst:

$$CH_2 = CH - CH_3 \xrightarrow{+O_2} CH_2 - CH - CH_3 \longrightarrow \text{Alum } CH_2 = OH - CH_2 - OH$$

In the present investigation, the glycerol conversion was studied at atmospheric or subatmospheric pressures at temperatures of 300° C.-600° C. over catalysts with a reductant like CO. A maximum yield of 16 per cent. allyl alcohol on glycerine converted was got at 300° C. over a catalyst (F_1) composed of a dehydrating component (A) and a deoxygenating component (B). A few representative data for the different catalysts tried at optimum temperatures are given in Table I.

The products contain allyl alcohol, polyglycerol and water. Polyglycerols are formed due to flash heating of glycerine and could be reconverted into glycerol.[8] Only minute traces of aldehyde (presumably acrolein) were detected with Fuchsine reagent. Allyl alcohol was tested according to Denige's method[9] and estimated by the bromide-bromate method recommended by Stritar.[10]

The following scheme illustrates the possible course of reaction on the catalyst surface:—



The formation of glycide over the dehydration catalyst was confirmed. The breaking of the epoxide as shown above is not in conformity with Krautskii's rule[11] and has no parallel in literature. Yet the reaction may occur through the interaction of a loose carbonyl-complex and its subsequent dissociation on the catalyst surface.

Now that the war is over, glycerine in India is in excess supply. Its conversion into allyl alcohol which is an important ingredient for plastics may be a commercial possibility.

TABLE I

Catalyst	Temperature °C.	% yield of allyl alcohol on glycerine passed	CO increase in c.c. contact gas, %	Allyl alcohol/gm. catalyst/hr.
A-1	320-350	3·6-4·5	less than 1·0	·24
B-1	280-300	5·7-6·9	nearly 1·0	·36
C-01	340-360	5·1	1·5	·306
C-1	230-250	6·3	2·1	·39
F-1	300-310	16·9	9·5	1·02

Dept. of General Chemistry,
Indian Institute of Science, J. C. GHOSH.
Bangalore, C. D. SRINIVASAN.
May 17, 1946. V. ARAVAMUTHAN.

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CHEMISTRY OF KURCHI SEEDS: PART II.[1] ISOLATION OF THE BROMIDE OF A LINOLEO-DILINOLENIN FROM THE FATTY OIL

THE fatty acids of Kurchi seed oil (*Holarrhena antidysenterica*) have been shown in these laboratories[2] to consist of linolenic (10 per cent.), linolic (54·7 per cent.), oleic (21 per cent.) and saturated acids (14·3 per cent.). But the arrangement of these in the molecules of the component glycerides has not been investigated so far. The present work is a contribution in this direction.

The glyceride structure of fats has been extensively studied in recent years by Hilditch and others[3] employing a fairly simple technique for the direct estimation of fully saturated triglycerides. Unfortunately, the estimation of other classes of glycerides, especially of unsaturated glycerides rests upon uncertain and less reliable methods.[4] It is not surprising, therefore, that the commonly accepted rule of "even distribution of fatty acids in mixed triglycerides" has shown marked deviations as a result of more careful recent work.[5]

For the estimation of glycerides containing unsaturated acids, the method of addition of bromine to the oil in a suitable solvent, followed by isolation of the crystalline mixed bromoglycerides has been adopted by previous workers.[6,7] But this procedure has not proved suitable for a quantitative estimation.

Adopting the bromination method, 24·5 gm. of kurchi seed oil dissolved in 110 c.c. of ether (dried over sodium) and cooled to about 5° C. yielded 10·5 gm. of an insoluble bromide melting at 107-13°. After washing this with a mixture of methyl alcohol and ether, 7·2 gm. (m.p. 116-18°) were obtained. Crystallisation of this from a mixture of absolute alcohol and benzene gave 2·1 gm. of white granular crystals melting at 154° (sharp). The bromine content of this, estimated by Stepanow's method, in duplicate, was found to be 58·2, 58·2, agreeing closely with the theoretical value (58·9) for the bromide of linoleo-dilinolenin.

The occurrence, therefore, of a linoleo-dilinolenin in kurchi seed oil, in spite of the low content of linolenic acid is one more deviation from the rule of even distribution quoted above. The work is being continued.

I am thankful to Mr. P. Ramaswami Ayyar for suggesting the problem and giving guidance, and to Dr. P. C. Guha for kind interest.

Dept. of Pure & Applied Chemistry,
Indian Institute of Science,
Bangalore, (MISS) R. J. IRANI.
June 8, 1946.

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ELIMINATION OF THE NITRO GROUP IN THE PROCESS OF DIAZOTISATION OF 2, 5-DICHLORO-4-NITRO-ANILINE

IN order to place beyond doubt the constitution of a tetrachlorobenzidine prepared from 2, 5-dichloro-nitrobenzene by electro-reduction, a synthesis of the substance was planned from 2, 5-dichloro-4-nitro-1-iodobenzene (I) as the starting material by Ullmann's method. The obvious method of preparing the latter substance would be the diazo replacement by iodine of the amino group in 2, 5-dichloro-4-nitro-aniline (II). On attempting the reaction, however, by the usual method of treating an ice-cold solution of the amine in acetic and hydrochloric acids with sodium nitrite and then adding potassium iodide to the clear

diazonium solution and heating, a nitrogen-free product melting at 105° (III) was obtained instead of the expected compound (I).

The new compound (III) was found to contain iodine and to be non-phenolic. Its structure as 2, 4, 5-trichloro-1-iodo benzene was established by coupling the diazo compound obtained from (II) with β-naphthol in alkaline solution and reducing the deep red azo dye (m.p. 197°) with stannous chloride and hydrochloric acid, when a mixture of 1-amino-2-naphthol and 2, 4, 5-trichloro aniline were obtained. The latter was separated by extraction with benzene in alkali and its identity established in the usual manner (m.p. 96°; acetyl derivative m.p. 190°).

The replacement of a nitro group by chlorine during the process of diazotisation of a nitroamine was first observed by Meldola and Eyre[1] in the case of 2, 3-dinitro-4-methoxy aniline. On the basis of an extended study of such cases, Meldola *et al.*[2] laid down certain conditions for such elimination to occur, *viz.*, that (*a*) the nitro group displaced should be either in the ortho or the para position to the diazo group and (*b*) there should be a second nitro group adjacent to the one which is knocked off. The observation that the displacement of the nitro group can take place even when there is no second nitro group but only a chlorine atom adjacent to itself does not appear to have been recorded in literature. In the present instance, the problem is complicated to some extent by the presence of a second chlorine atom in the meta position to the nitro group which is knocked off. In accordance with the observations made by Kenner[3] that an ortho-para-orienting group such as chlorine has the power to labilize groups in the meta position with respect to itself, the probability is not ruled out that the second chlorine atom has also some influence in bringing about the displacement of the nitro group. While the relative shares of influence exerted by the two chlorine atoms can be determined only by further investigations in this field, it is permissible in the light of the observations made so far, to extend the postulate of Meldola and others by stating that the second group adjacent to the group displaced need not be a nitro group but may also be a chlorine atom.

It has been found that if the diazotisation of (II) is carried out in the absence of hydrochloric acid by dissolving the amine in acetic and sulphuric acids, there is no disturbance of the nitro group and the desired iodo derivative (I, m.p. 84°) could be prepared in excellent yields (80 per cent.). That the reaction proceeds in these circumstances in the normal manner without elimination of the nitro group has been further confirmed by coupling the diazo compound with alkaline β-naphthol and reducing the resulting azo dye (m.p. 236°) with stannous chloride and hydrochloric acid, when 2, 5-dichloro-1, 4-diamino benzene (m.p. 168°; acetyl derivative m.p. 296°) was obtained, besides 1-amino-2-naphthol. A similar observation has been made[4] with 1-nitro-2-amino naphthalene where the nitro group is replaced by chlorine when the diazotisation is carried out in the presence of hydrochloric acid, although no such replacement occurs if sulphuric acid is used instead.

Fuller details of this investigation will be published elsewhere in due course. Our thanks are due to the Council of Scientific and Industrial Research under whose auspices this work has been carried out, for their kind permission to publish the results.

Presidency College, Madras, *May* 16, 1946.

B. B. Dey.
T. R. Govindachari.
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SOLVENT EXTRACTION IN A SPRAY COLUMN

In view of the growing importance of countercurrent liquid-liquid extraction, as a Chemical Engineering unit operation, the study of the performance of the different types of continuous extraction columns was undertaken with the system nitrobenzene-acetic acid-water and some data on extraction in a 1·36″ diameter glass spray column are given below. It is proposed to continue the study in packed and sieve-plate columns and the entire paper will be published elsewhere.

The equilibrium distribution data at 25° C. for the system nitrobenzene-acetic acid-water were taken from literature.[1] The results are expressed in terms of the overall extraction coefficient $K_N a$ and the corresponding $(H.T.U.)_{ON}$ based on the nitrobenzene phase since the nitrobenzene film offers the major resistance to acid transfer.

Table I shows the effect of changing the inlet acid concentration of nitrobenzene on $K_N a$ and $(H.T.U.)_{ON}$.

Table I

Nitrobenzene flow rate = 29·0 cu. ft./hr./sq. ft. tower cross-section.
Acid solution flow rate = 26·9 c. ft./hr./sq. ft. tower cross-section.
Extraction height = 3 feet.

Inlet acid concn. of Nitrobenzene in lb. mols / cu. feet	Inlet acid concn. of acid solution lb. mols./cu. ft.	Nitrobenzene dispersed		Acid dispersed	
		$K_N a$	$(H.T.U.)_{ON}$	$K_N a$	$(H.T.U.)_{ON}$
0·000024	0·04258	7·8	3·7	9·6	3·0
0·000475	,,	8·1	3·6	9·4	3·1
0·001304	,,	7·4	3·9	9·8	3·0
0·001728	,,	9·6	3·0	12·2	2·4

Table II shows the effect of ~~changing the~~ inlet acid concentration of nitrobenzene on $K_N a$ and $(H.T.U.)_{ON}$.

acid solution and the influence of extraction height

TABLE II

Nitrobenzene flow rate = 20·1 cu. ft./hr./sq. ft. Acid solution flow rate = 26·5 cu. ft./hr./sq. ft.
Inlet acid concen. of Nitrobenzene : Traces (0·000041 — ·000062 lb. mols./cu. ft.)

Height of column in feet	Nitrobenzene dispersed				Acid dispersed			
	Inlet acid concentration of acid solution lb. mols./cu ft.							
	·0205		·0737		·1123		·0205	
	K_Na	(H.T.U.)$_{ON}$	K_Na	(H.T.U.)$_{ON}$	K_Na	(H.T.U.)$_{ON}$	K_Na	(H.T.U.)$_{ON}$
3·0	6·5	3·1	6·3	3·2	6·3	3·2	·1	2·5
2·0	5·9	3·4	5·9	3·4	6·8	3·0	8·0	2·5
1·0	7·5	2·7	7·3	2·8	9·2	2·2	11·1	1·8
0·5	12·1	1·7	12·8	1·6	12·9	1·6	14·4	1·4

Height of column in feet	Acid dispersed			
	Inlet acid concentration of acid solution lb. mols./cu ft.			
	·0737		·1123	
	K_Na	(H.T.U.)$_{ON}$	K_Na	(H.T.U.)$_{ON}$
3·0	8·0	2·5	8·0	2·5
2·0	8·5	2·4	9·5	2·1
1·0	11·7	1·7	12·3	1·6
0·5	14·6	1·4	13·2	1·5

From the above it can be concluded (i) that K_Na remains more or less constant with the increase in inlet acid concentration of either solvent, (ii) that there is a progressive increase in K_Na and a corresponding decrease in (H.T.U.)$_{ON}$ with decrease in extraction height and (iii) that the values of K_Na and (H.T.U.)$_{ON}$ become almost identical at 0·5 feet for the two phases dispersed, though for the other extraction heights K_Na is always more and (H.T.U.)$_{ON}$ less, for the acid phase dispersed.

From the amount of solute extracted expressed as a percentage of the total extraction in a 3 feet column, it is seen that about 45 per cent. of the total extraction taking place in a 3 feet column, occurs within 6 inches of the column, showing that appreciable extraction takes place as the drops are formed from the spray nozzle.[2]

We have great pleasure in acknowledging our deep gratitude to Sir J. C. Ghosh for his valuable suggestions and help during the course of this experiment.

Chemical Engg. Section,
Indian Institute of Science, S. K. NANDI.
Bangalore, T. R. VISWANATHAN
May 24, 1946.

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ELECTROLYTIC REDUCTION OF META-DINITROBENZENE TO 2, 4-DIAMINOPHENOL

2, 4-DIAMINOPHENOL salts are used extensively as photographic developers under various trade names such as "Amidol", "Diamol", "Dolmi", etc. The technical preparation of this valuable photographic chemical is commonly carried out by reducing 2, 4-dinitro-phenol either with a metal and acid or electrolytically.[1] The only reference in literature to the direct production of the diaminophenol from meta-dinitrobenzene by electrolytic reduction is that of Gattermann[2] who obtained it by electrolysing a solution of meta-dinitrobenzene or meta-nitraniline in concentrated sulphuric acid using a platinum cathode. The yield obtained, however, is not specified.

The preparation of para-amino-phenol in nearly 70 per cent. yield by the electrolytic reduction of nitrobenzene in dilute sulphuric acid emulsion using a copper or monel cathode and a suitable catalyst has already been reported from this laboratory.[3] A study of the electrolytic reduction of meta-dinitrobenzene in sulphuric acid emulsion on similar lines was undertaken sometime ago with special reference to the influence of such factors as strength of acid, concentration of depolariser, composition of cathode material, current density, catalyst, etc., on the nature and yield of the products. 2, 4-Diaminophenol has now been obtained in a yield of nearly 50 per cent. by electrolysing an emulsion of meta-dinitrobenzene with 40 per cent. sulphuric acid at either monel or copper cathodes using a suitable catalyst and a current density of 5 amps. per sq. dm. While further experiments are in progress for improving the yield, it may be said that the results obtained so far promise to serve as a convenient basis for the technical manufacture of this important chemical.

Bradt and Brown (*loc. cit.*) have used the ordinary method of estimation of amino-groups with sodium nitrite for computing their yields of diaminophenol—an obviously unreliable method, considering the fact that the estimation was carried out in a mixture in which other amino-compounds might be present. Indeed meta-phenylene-diamine in varying amounts was always found to accompany the diaminophenol in our experiments so that the method of procedure of the previous authors for calculating the yields of diaminophenol is definitely ruled out. Fortunately, 2, 4-diamino-phenol is found to form a very sparingly soluble oxalate[4] with the aid of which an almost quantitative separation of the pure product is possible. The over-all yields of diaminophenol obtained in our experiments have always been calculated from the weights of the pure dry oxalate.

Fuller details of the investigation will be published elsewhere in due course. Our grate-

ful thanks are due to the Council of Scientific and Industrial Research for kind permission to publish the preliminary results.

Presidency College, Madras, *May* 16, 1946.

B. B. DEY.
T. R. GOVINDACHARI.
H. V. K. UDUPA.

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THE CHROMOSOME NUMBER IN *TORULA UTILIS*

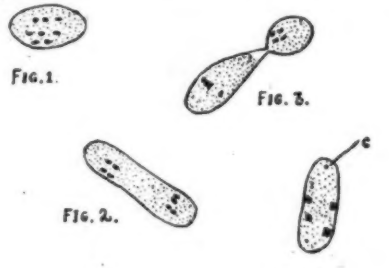
RECENTLY much work has been done on the cytogenesis of *Saccharomyces cerevisiæ*. Since *Torula utilis* is of great importance in the vitamin B industry, a study of its cytology is important.

The strain of *Torula utilis* used was one maintained in the laboratory, originally obtained from Dr. A. C. Thaysen, Chemical Research Laboratory, Teddington, and sent by Dr. M. Qureshi, Director, Central Laboratories, Hyderabad (Deccan). The strain was grown for this work both in liquid and solid media. To get smears of actively dividing cells and of the same stage fresh cultures were used.

Smears of this organism were treated with several routine fixatives and stains, but the best fixative proved to be Carnoy. Of the several stains used, Toluidine blue[1] gave excellent results as was suggested to us by Srinath's communication.[2] Heidenhain's hematoxylin, however, did not give satisfactory results. Fresh smears were fixed in Carnoy's fluid for 45-60 minutes, then removed to absolute alcohol. The smears were brought to water, passing through grades of alcohol and kept in one per cent. aqueous Toluidine blue for 30 minutes. Previous workers do not mention to that effect but we find in order to get good results fresh Toluidine blue solution is essential. The smears were washed in water and were differentiated in 50 per cent. acid alcohol. Finally the smears were cleared in clove oil and kept in xylol for a few minutes and mounted in neutral balsam.

In a well-stained and differentiated smear chromosomes are stained deep pink and the ground cytoplasm light blue. It is interesting to note how in this organism the division and arrangement of the chromosomes takes place. There is dispute as to how the nucleus of the yeast divides during budding.[3] The nucleus of *Torula utilis* divides mitotically and it has been observed that the chromosomes split longitudinally. After the preliminary divisions of the nucleus in a budding cell, eight chromosomes are seen scattered as in Fig. 1. After this stage the cell elongates and four chromosomes on either side begin to separate as shown in Fig. 2. Then a constriction is formed as in Fig. 3 and the organism divides into two with four chromosomes in each.

It has been observed in some cells that in addition to eight chromosomes two more bodies are also seen. These bodies are different in shape and size. Further Toluidine blue stains them lightly as compared with chromosomes. These two extra bodies are identical with each other and are found always aloof from the chromosomes and are often seen towards the poles of the budding cell as shown in Fig. 4 c. As we know that the shape and size of the chromosomes are genetically controlled, so the two extra bodies may be regarded as centrioles.



X 1200.

This work was done in Prof. S. Mahdihassan's Laboratory. We are much thankful to him for his active interest and guidance.

Biochemistry Department, Osmania Medical College, Hyderabad (Dn.), *May* 20, 1946.

MOHANBABU NAIDU.
V. M. BAKSHI.

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INDUCING FLOWERING IN NON-FLOWERING SUGARCANES

IN certain sugarcane varieties flowering is not normal, the reproductive phase being very often completely suppressed or only partially expressed showing all types of sexual degeneration and arrested floral development. It often happens that a variety which should otherwise make an excellent breeding material fails to flower at the Breeding Station. In the past little evidence has been produced to show that persistently non-flowering cane varieties could be induced to flower. In a previous note[1] a brief account was given of the results of investigation into the photoperiod factor in relation to flowering in sugarcanes. The close relationship existing between the two was emphasised and certain treatments were suggested for inducing flowering and delaying the times of flowering. The sugarcane varieties, however, differ greatly in their photoperiodic requirements and that

makes it necessary to tackle the varieties individually and evolve a different photoperiodic treatment for each one of the numerous varieties which do not flower at this Station, which is obviously not easy to achieve, considering the expense and difficulties involved in manipulating the photoperiod under field conditions. In the hope of evolving a practice that could be more easily manipulated, another line of investigation was pursued and studies were made into on the effects of manuring and irrigation on flowering in sugarcane. Baretto[2] studied the flowering behaviour of several cane varieties and he concluded that the factors influencing the flowering of sugarcane are unknown. He, however, observed that in the years of copious rainfall flowering may become pronounced in the varieties P.O.J. 2714, P.O.J. 2878 and P.O.J. 2882. Evans[3] made various experiments on arrowing in sugarcane and he found that heavy applications of phosphates or nitrates inhibit arrowing in this plant. Recently Kerr[4] observed that where the cane received no sulphate of ammonia fertilizer the percentage of arrowed stalk was 71, when 200 lb. sulphate of ammonia and 400 lb. sulphate of ammonia per acre had been applied the percentages of flowering were 54 and 11 respectively.

It is the usual practice at this Station to manure the cane fields with a mixture of ammonium sulphate and groundnut-cake in three doses, at planting, at three months and at six months. The total quantity of the manure applied is 240 lb. ammonium sulphate and 2,600 lb. groundnut cake per acre. To see if manuring at this rate in any way inhibited flowering in cane varieties, a preliminary pot-culture experiment was run in 1943 with two non-flowering North Indian types, *viz.*, Baroukha 13 A and Sewari. Ten plants from each of the two varieties were grown in large-sized pots containing the ordinary garden land soil, each pot supporting one plant. Four plants from each variety were manured with a finely powdered mixture of ammonium sulphate and groundnut cake, in two doses, at three months and at six months. Each dose consisted of 2 gm. ammonium sulphate and 10 gm. groundnut cake. The remaining plants were kept unmanured. It was observed that eight months after planting the unmanured plants of both the varieties came to flower and striking feature was that each tiller of these plants was in flower. The manured plants grew vigorously but did not show any sign whatever of flowering. These results were confirmed in 1944 and it was further observed that certain varieties like P.5649 flowered when manuring was reduced from the usual three doses to the two initial doses, applied at the first month and the third month (Fig. 1). Some varieties such as P.4626 flowered best when manuring was reduced to a single initial dose at planting; while some others flowered only when no manure was applied. Heavy doses of manure—ammonium sulphate and groundnut cake—applied at fourth and seventh month, delayed and inhibited flowering even in such profusely flowering varieties as Co.421. In certain cases one heavy dose of manure applied at sixth or seventh month was found enough to completely inhibit flowering.

No manure | 1 dose manure at planting | 2 doses manure at planting & at 3 months | 3 doses manure at planting at 3 months & 9 months | 1 dose manure at 7 months

FIG. 1. Showing the effect of manuring (Amm. Sulphate + G. N. Cake) on flowering in the cane variety P. 5649.

The field tests carried out simultaneously showed that besides manuring, irrigation was another important factor very closely concerned with flowering in sugarcanes. Thus when irrigation was increased to twice that of the normal, certain non-flowering varieties like Red Mauritius and Nargori 15 D, came to flower and as the water supply was further increased to alternate day and daily irrigation even such persistently non-flowering varieties as Co.468 flowered. To gain further information on the two factors, manuring and irrigation, in regard to flowering, a more comprehensive experiment was laid out in the beginning of the year 1945. Seven varieties, *viz.*, Red Mauritius, Co.468, P.5649, Poovan, S.s. Assam (301), B.3013 and P.4626, were used in this experiment and several conditions of manuring and irrigation were studied. The success achieved was phenomenal and six out of the above-mentioned seven varieties were induced to flower. The results are briefly described below.

The flowering season at Coimbatore commences in the beginning of October and it continues to the middle of December. Red Mauritius and Co.468, the two important thick cane varieties, which are not known to flower at this Station, flowered profusely with the treatment of alternate day irrigation; about 70 per cent. and 72 per cent. of the stalks flowered, respectively. Only a light initial dose of the mixture—bonemeal and groundnut cake—was applied to these plots. The controls, which received usual three doses of the mixture—ammonium sulphate and groundnut cake—and normal irrigation, *i.e.*, once a week, did not show any sign of flowering (Fig. 2).

P.5649, another non-flowering thick cane variety, flowered only when subjected to daily irrigation conditions from July to September, a period of three months prior to commencement of flowering season. It gave about 40 per cent. of flowering.

Poovan, which is still another important non-flowering thick cane variety, and S.s.

FIG. 2. Showing the effect of irrigation on flowering cane varieties.

Assam 301, a non-flowering wild form, gave the best results with the treatment of daily irrigation throughout the growth period and a single initial manuring with bonemeal and groundnut cake, at planting. The flowering, however, was not profuse but half a dozen of healthy arrows were in each case available for crossing purposes. The controls of these varieties did not show any sign of flowering.

The variety P.4626, which is late and sparsely flowering, flowered early and very profusely with the above treatment of daily irrigation. The arrowing commenced in the beginning of October and by the end of October about 50 per cent. of the stalks had arrowed. The controls flowered in November and produced only one arrow.

The variety B.3013 could not be induced to flower with any of the above treatments.

The above experiments indicate that a copious supply of water throughout the growing period conduces to flowering in sugarcane; that excessive manuring, particularly in the later stages of growth, delays and inhibits flowering, and that by simply adjusting the conditions of manuring and irrigation it is possible to induce flowering and control the times of flowering in the cane varieties desired to be included in the breeding programme at this Station. The author is greatly indebted to Mr. N. L. Dutt, Government Sugarcane Expert, for his keen interest and valuable criticism throughout this investigation.

Imperial Sugarcane Station,
Coimbatore,
January 1946. N. D. YUSUF.

1. Yusuf, N. D., and Dutt, N. L., *Curr. Sci.*, Nov. 1945, **11**, 304–06. 2. Barretto, B. T., *Proc. Asoc. Tec. Azucarros de Cubae*, 1934, **8**, 29–33. 3. Evans, H., *Rept. Sugarcane Research Station (Mauritius)*, 1934, **5**, 40–43. 4. Kerr, H. W., *Cane Growers' Quarterly Bulletin*, Queensland, 1940, **8**, 2, 76.

THE MICRO-ORGANISMS IN *MELOPHAGUS OVINUS*

SMEARS of the intestine of *Melophagus ovinus* show the presence of a Rickettsia. Miss H. Sikora, then working with Prof. Nöller, kindly showed to me how they can be stained with Giemsa's stain. They give a microscopic picture identical with that reproduced by Cowdry.[1] Prof. Nöller, then Director of the Institute of the Institute of Parasitology, Veterinary College, Berlin, kindly demonstrated to me the technique of cultivating the Rickettsia on N.N.N. agar with defibrinated horse blood. The germs grew in about 15 days and gave the same

picture as those of the smears. Nöller's Monograph[2] gives details of the technique. The Rickettsia is extracellular in the intestinal lumen of the insect.

Zacharias[3] has published a thesis on the symbiosis of *M. ovinus*. There is a localised region in the intestine where the epithelium contains symbiotic bacteria. Zacharias illustrates the symbiote on p. 692 (Fig. 7); and on p. 701 (Fig. 16). The smears stained with Giemsa show a far larger size of the germs than the Rickettsia and the N.N.N. agar does not serve as a suitable medium for their cultivation. The usual prune juice agar with the addition of liver extract and a trace of ferric chloride enabled the isolation of the symbiote within a week. The germ resembled a Micrococcus species and identical with the illustrations of Zacharias. A loopful of the culture was introduced in defibrinated sheep's blood. It was subsequently found that the white blood cells in this blood were all full with a growth of these Micrococci. It is well known that Gonococcus likewise prefers to multiply in white blood cells rather than in free blood. The explanation in this case has been offered to be the relatively more alkaline pH of the white blood cell which is about 7·2 as compared with that of the body fluids with a pH 6·8. The prune juice agar had a pH 6·8 where the germs did grow while it was also evident that the white blood cells of the sheep proved a better medium for their development. The symbiote of *M. ovinus* did not putrefy sheep's blood nor coagulate it in any way. The isolation was repeated several times and with success.

Zacharias also mentions the occasional presence of another bacterium found intercellularly in the intestinal epithelium of *M. ovinus*. Only once did I get a bacterial culture which gave delicate long rods as illustrated by Zacharias, p. 691 (Fig. 6). For a long time I had doubted his finding but this confirmation gives credit to his observation.

He further mentions the existence of a saprophytic trypanosome in the intestinal fluid of *M. ovinus*, in which I was not interested.

The work was done at Munich, in the laboratory of Prof. Seiler, now at Zürich, to whom I beg to thank once again here.

Biochemical Laboratory,
Osmania Medical College,
Hyderabad (Dn.), S. MAHDIHASSAN.
May 13, 1946.

1. Cowdry, E. V., "Cytological Studies on Heartwater" *11th and 12th Rept. of Director of Veterinary Research*, Union of South Africa, Pretoria; 1927, 196, pl. 1. fig. 2. 2. *Handbuch d. Pathogenen Protozoen*. 12 Lieferung. Leipzig, 1928. 3. *Zeit. f. Morpho. u. Ökologie.*; 1928, 10.

ON THE BIONOMICS OF THE SILVER FISH, *CHELA ARGENTEA*, DAY

Chela untrahi Day. *C. argentea* (Cuv. & Val.), *C. phulo* (Ham. Buch.), *C. boopis* Day., and *C. clupeoides* (Bloch.) are the five species of silver fishes occurring in the inland waters of the Madras Presidency (Day., 1889). They prefer quiet waters and deep pools of rivers, but are active fishes keeping to the surface during day and twilight hours (Sundararaj, 1916). They grow to a size of 6 to 9 inches; and are esteemed as food. They are popular with anglers, as they spring out of the water after the bait (Thomas, 1881).

The food of *Chela argentea*, as revealed by the examination of the stomach-contents of over 500 specimens, consists of (1) algal matter (*Anabœna, Cladophora, Oscillatoria, Pediastrum, Spirulina* and *Spyrogyra*)—10 per cent.; (2) crustaceans (copepods and daphnids)—15 per cent.; (3) diatoms and desmids (*Closterium, Cocconeis, Cosmarium, Cyclotella, Cymbella, Eunotia, Melosira, Navicula, Nitzschia, Pinnularia, Saurirella, Synedra* and *Tabellaria*) —30 per cent.; (4) insect parts—40 per cent.; and (5) sand particles and other inorganic matter—5 per cent. A few fish scales were observed in the stomach of about a dozen specimens.

The fish is a surface feeder, insect life forming the bulk of its diet; and is, therefore, a useful larvicide (Wilson, 1917). Many have stressed the importance of this fish in the control of mosquito incidence (Hora and Mukerji, 1938; Spence and Prater, 1932). Field observations by us have revealed that one specimen of *Chela argentea* feeds on about 100 mosquito larvæ together with other items of its food in a period of twenty-four hours.

The fish breeds in running waters during the monsoons from July to October. During the breeding season, the female has the ventral portion of its body slightly coloured orange or yellow. The ripe ovarian egg is yellowish, round, and 1·20 to 1·50 mm. in diameter. The eggs get swollen immediately after fertilisation, and measures 2·0 to 2·50 mm. in diameter. In about 12 hours, the embryo attains a length of 3·5 mm. and lies curved over the yolk-mass over which light bluish pigments have appeared. Within another eight hours, the embryo hatches out. The larva at this stage is 5 mm. in length, and possesses four gill-slits and a continuous fin-fold. When the larva is four hours old, it measures 8 mm. with well-developed eyes and mouth. The yolk-sac is completely absorbed. Pectoral fin buds become prominent. Scattered bluish pigments appear on the dorsal half of the body. When the larva is 12 mm. in size, the paired and unpaired fins get differentiated. The mouth gets turned upwards. About the alimentary coil, the air bladder appears as a bright capsule. At the size of 15 mm., the fins and operculum are fully developed; and the air-bladder becomes bilobed. At the end of one month after hatching, the fry become 20 mm. in size, and is characterised by a thin laterally compressed body, pellucid cream-white in colour, straight, rostro-dorsal profile, a V-shaped dotted, bluish pattern on the head, and prominent blue eyes.

Inland Fisheries Office, P. I. CHACKO.
Kilpauk, Madras, R. S. VENKATRAMAN.
April 4, 1946. V. RANGANATHAN.

*Published with the kind permission of the Director of Industries and Commerce, Madras.

TAMARIND SEED PECTIN

DAMODARAN AND RANGACHARI[1] have reported that tamarind-seed pectin contains 1·08 per cent. of methoxyl, 33·22 per cent. of araban, 53·11 per cent. of glucosan, 12·59 per cent. of uronic acid and zero value for the calcium pectate number. An examination of these data reveals certain discrepancies regarding the presence of the uronic acid grouping in the molecule. The zero value for the calcium pectate number does not offer support to the existence of the uronic acid nucleus, since the method of Dickson, Otterson and Link (estimation of uronic acid) and the reaction of Carre and Haynes (determination of calcium pectate number) are both dependent on the existence of the same uronic acid grouping. From their data the authors have concluded that the tamarind-seed preparation is a mucilege, since it resembles certain seed mucilages in its chemical composition.[1,2] The examples cited by them do not, however, warrant such a conclusion being drawn. The mucilage from the seeds of *Plantago lanceolata* Linn. yields on hydrolysis 72 per cent. of xylose, 11 per cent. of methyl pentose, 15 per cent. of uronic anhydride and a small amount of galactose,[3] while the mucilage from the seeds of *P. psyllium* Linn. contains 75 to 90 per cent. of xylose and a little arabinose, the rest being galacturonic acid.[4] The composition of the mucilage from the seeds of *P. fastigiata* is similar to that of *P. psyllium*.[5] A comparison of the analytical data of these mucilages with the figures given by Damodaran and Rangachari for the tamarind-seed pectin shows that there is not much in common between them except the reported but unconfirmed[6,7,8] uronic acid content.

The pectic substance from the tamarind seed differs from mucilages in several respects.[9] It is true that, unlike the fruit pectins, it is not a derivative of galacturonic acid. But on account of its characteristic property of forming acid-sugar-jellies, it is to be regarded as a pectin, since the word is now-a-days used as a generic term.[10,11]

Forest Research Institute, Dehra Dun,
April 25, 1946.

P. S. RAO.
S. KRISHNA.

1. Damodaran and Rangachari, *Curr. Sci.*, 1945, **14**, 203. 2. —, *Ibid.*, 1946, **15**, 20. 3. Mullan and Percival, *J. Chem. Soc.*, 1940, **15**, 1501. 4. Anderson and Fireman, *J. Biol. Chem.*, 1935, **109**, 437. 5. Anderson, Gillette and Sealey, *Ibid.*, 1941, **140**, 569. 6. Ghose and Krishna, *Curr. Sci.*, 1945, **14**, 299. 7. Nanji, Savur and Sreenivasan, *Ibid.*, 1945, **14**, 129. 8. Savur and Sreenivasan, *Ibid.*, 1946, **15**, 43. 9. Ghose, Krishna and Suryaprakasa Rao, *J. Sci. & Ind. Res.* 1946, **4**. 10. Hinton, *Fruit Pectins: Their Chemical Behaviour and Jellying Properties*, printed by His Majesty's Stationery Office, London, 1939, pp. 1, 44 and 92. 11. Rao and Krishna, *Chemistry & Industry*, 1946, **65**, 101.

TAMARIND SEED "PECTIN"

IN the carefully reasoned Report of the American Chemical Society on Pectin Nomenclature,[1] pectic substances have been worded as "a group designation for those complex carbohydrate derivatives which occur in plants or are prepared from plants and which are characterized by the presence of galacturonic acid units". Other defining characteristics of pectin are the presence of methyl ester groups and the formation, through de-estherification, of pectic acid.[2] It is now recognized that the polysaccharide from tamarind seed differs in all these respects from pectin[3,4] and hence, to class it as one, would be solely on its property of forming sugar-acid jellies.[5] Such a classification, based purely on physical behaviour and not on any constitutional knowledge, would be haphazard and confusing.[6]

The polysaccharide cannot be called a mucilage either;[7] for, recent work has shown that substances commonly described as gums and mucilages, are in fact polyuronides and that their acidic properties are due to the presence of uronic acid whence the name, sometimes given to them, 'acidic polyuronides'.[8]

In an earlier communication,[4] the authors had referred to the polysachharide as a glucogalacto-xylan and there is little doubt that it is a *polyose* or *hexopentosan*[9] which nomenclature we would, therefore, suggest for adoption in future.

Dept. of Chem. Technology,
Bombay University,
May 28, 1946.

G. R. SAVUR.
A. SREENIVASAN.

1. Committee on Pectin Nomenclature, *Jour. Amer. Chem. Soc. (Proceedings)*, 1927, **49**, 37. 2. Nanji, Savur and Sreenivasan, *Curr. Sci.*, 1945, **14**, 129. 3. Ghose and Krishna, *Ibid.*, 1945, **14**, 299, 4. Savur and Sreenivasan, *Ibid.*, 1946, **15**, 43. 5. Rao and Krishna, *Chem. and Ind.*, 1946, **9**, 101. 6. Norman, *The Biochemistry of Cellulose, the Polyuronides, Lignin, &c.*, Oxford Univ. Press, 1937, 121. 7. Damodaran and Rangachari, *Curr. Sci.*, 1946, **15**, 20. 8. Norman, same as (6), p. 122. 9. Norman, same as (6), p. 39.

STUDIES ON THE METABOLIC FAECAL NITROGEN OF CATTLE

ENDOGENOUS urinary nitrogen and metabolic fæcal nitrogen (M.F.N.) values of experimental subjects are essential prerequisites for determining the biological value of proteins according to the Thomas-Mitchell method. Since published experiments on the determination of these data lack scientific precision, a series of investigations was initiated in 1940. The observations on endogenous nitrogen have already been published.[1] The present note gives a short account of studies on M.F.N., details of which will be published elsewhere.

In studying the M.F.N., the first step was to develop a simplified technique, by (1) substituting a low-nitrogen ration for the compara-

tively less palatable nitrogen-free ration, and (2) computing the results by the use of a correction factor. Skim milk protein was found to be unsuitable for incorporation in the low-N diets.

A highly significant quantitative relationship was discovered between the level of fæcal dry-matter output and the M.F.N. of cattle. This relationship is shown in the accompanying graph (Fig. 1). This graph will enable the

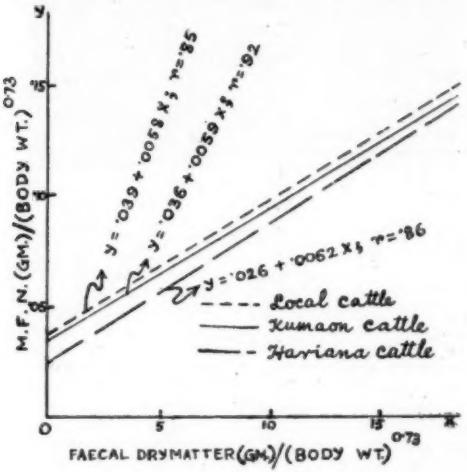


FIG. 1. Relation between daily output of M.F.N. and fæcal dry matter of cattle.

estimation of the M.F.N. of cattle (at least of the three types of cattle studied, namely, Hariana, Kumaon and local non-descript), when the daily excretion of fæcal dry-matter is known.

It has been found that breed characteristics and moisture content of the fresh fæces exert a negligible influence on the value of M.F.N. It was further observed that the M.F.N. of cattle on the same ration decreased with a higher intake of food. The level of fæcal dry-matter output, however, was the predominant factor affecting the M.F.N. of cattle.

Animal Nutrition Section, R. MUKHERJEE.
Imperial Veterinary Research N. D. KEHAR.
Institute, Izatnagar,
April 25, 1946.

1. Kehar, N. D., Mukherjee, R., and Sen, K. C., *Ind. J. Vet. Sci. & Ani. Husb.*, 1943, **13**, 257.

A CASE OF POLYEMBRYONY IN *DAPHNE CANNABINA* WALL.

DURING an embryological study of a few members of the family Thymalæaceæ, it is found that, usually, a single embryo is developed in each ovule. It develops from the fertilised egg and follows the Asterad type of embryo development. In *Daphne cannabina*, however, a single case has been encountered in which two embryos are developed in an ovule (Fig. 1). One of the two embryos is at a slightly more advanced stage of development. One of them is evidently developed from the fertilised egg and the other seems to have developed from nucellar cells in the apical region of the ovule.

FIG. 1. *Daphne cannabina*. Micro-photograph of L.S. the upper part of the ovule showing two embryos.

Judging from the position of the embryos, the extra embryo could have arisen from a synergid also. But, during the course of the investigation neither egg-like synergids nor additional pollen tubes entering the ovules have been found. Therefore, the origin of the second embryo, from a synergid, seems to be unlikely. Previously, Winkler[1] (1906) recorded a case of nucellar embryony in *Wikstrœmia indica*. In this case, however, the embryo fails to develop from the egg and the single embryo seen is developed from the nucellar cells in the apical region of the ovule.

Andhra University,
Guntur, J. VENKATESWARLU.
March 15, 1946.

1. Winkler, *Ann. Jard. Buitenzorg*, 1906, **2**, 5.

DOES POTASSIUM STIMULATE BY RELEASING ACETYLCHOLINE?

IT has been presumed that potassium stimulates by releasing acetylcholine.[1] The following facts are, however, against this suggestion:— (1) Brown and Feldberg[2] found that curarine, in suitable doses, was found to paralyse the ganglion cell to preganglionic stimulation and to acetylcholine while leaving the cellular response to potassium chloride actually enhanced. Curare has similar action on *mytilus* muscle and frog gastrocnemius.[3] (2) In frog stomach eserine (1 in 10^5) increases the response to acetylcholine but depresses that to potassium.[4] (3) In dog stomach excess of calcium depresses the response to acetylcholine, but increases

that to potassium, the effect of hydrogen ions being also similar.[5,6]

Department of Physiology, Dow Medical College, Karachi,
May 21, 1946.

M. C. MUTHANA.
INDERJIT SINGH.

1. Ambache, N., *J. Physiol.*, 1946 **104**, 266. 2. Brown, G. L., and Feldberg, W., *Ibid.*, 1936, **86**, 10. 3, 4, 5. Singh, *I.*, *Proc. Ind. Acad. Sci.*, 1946, **23**, 58; *J. Physiol.* 1939, **96**, 25; 1940, **98**, 155. 6. Narayana, B., and Singh, *I.*, *Proc. Ind. Acad. Sci.*, 1944, **20**, 192.

A NEW MUTANT IN ASIATIC COTTONS

A NEW mutant was noticed in Asiatic cottons in 1942-43 and its description and inheritance are reported in this note.

The mutant which occurred in a crop of 1027 A.L.F. (*G. herbaceum*), grown in a cultivator's field in the Navasari district of Baroda State, attracted attention mainly due to its monopodial habit and failure to set bolls even at an advanced stage. The buds were abnormal in that the petals and bracts had an indefinite number of whorls with a very compact arrangement and in a majority of cases they shed even without opening. In three flowers which did open later the number of petals was found to range from 7 to 12 instead of the normal 5. To study the behaviour of the mutant (Fig. 1), a normally opened flower was brought to Baroda and crossed with two plants of *G. arboreum*. Both these belonged to the New Multiple Recessive isolated at this Station from a cross of N6 Multiple Recessive with Cocanada 45, one however being heterozygous for the petal colour gene. Only 3 F_1 plants were available from the cross and all the three had normal flowers. The data from F_2 grown in 1944-45 are given below.

In a total population of 143 plants in F_2, 108 plants produced normal flowers while 35 plants gave flowers characteristic of the mutant, which means that the mutant type is a simple recessive to the normal.

Linkage studies were also made side by side as the parents with which the mutant was crossed at Baroda were recessive for a number

FIG. 1

of characters. The summary of the results is given in Table I.

It can be seen from the table that the segregation obtained in F_2 give a good fit to the 9 : 3 : 3 : 1 dihybrid ratio and that there are no disturbances in the single-factor ratios. The mutant gene is thus not linked and assorts independently of other genes for leaf nectaries, petal colour, pollen colour and anthocyanin pigmentation. Further study of the linkage of the same, if any, with other genes such as for lint colour and leaf-shape is in progress. It was observed in the F_2 that most of the mutant plants besides being monopodial in growth habit had flowers appearing as twins from the same axil unlike the normal plants. The question whether the above is due to a pleiotropic effect of the mutant gene is under investigation. The mutant is characterised by very poor fertility and even with twin flowers any boll that is obtained is only from one of them. The gene pair responsible for the normal and the multi-bracteolata flowers may be tentatively designated as $M^a - m^b$.

TABLE I

Two-factor ratios of crosses of the mutant with the New Multiple Recessive

The mutant flower and		Normal flower		Mutant flower		Total	X^2	P
		X	x	X	x			
F_2, *Ne–ne*	obs.	82	26	26	9	143	0·0800	Large
Ya–ya	,,	51	15	12	4	82	1·5122	0·70–0·50
Pb–pb	,,	89	19	23	6	137	4·6383	0·30–0·20
$R_2AS–R_2OS$	,,	89	19	28	7	143	3·6604	0·50–0·30

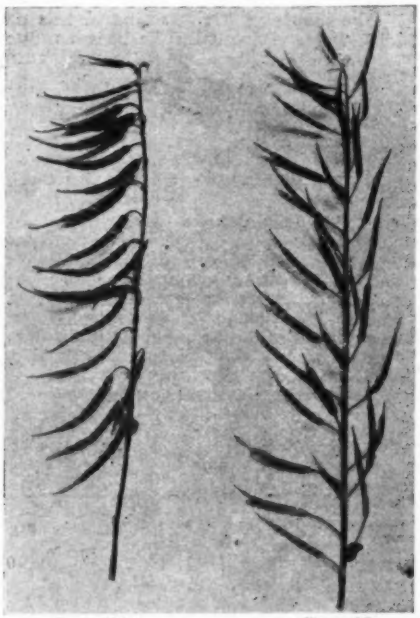
Baroda,
March 26, 1946.

G. K. GOVANDE,
Economic Botanist.

A MISSING TYPE OF *BRASSICA CAMPESTRIS* RECOVERED

A CLASSIFICATION of the cultivated Indian mustards has been described by Sabnis and Phatak (1935). They have described thirty-five types of *Brassica campestris* L. One of these types, T.33, belonging to the *Pronisiliquosa* group, was not found among the cultivated types in existence and was described on the basis of herbarium specimens from the Royal Botanical Gardens, Calcutta. It had two-valved, pendant pods (unlike the common cultivated types of *Erectisiliquosa* group which have spreading or ascending pods), and was included in the classification to make it somewhat complete.

This missing type has now been recovered in a collection of new samples of *sarson* (*B. campestris* L.) made in 1941 from the different districts of the United Provinces. This type, named 4114, was discovered in a sample of *sarson* from village Jaitipur, district Unao. It has two-valved, pendant pods, and is constant for these characters. It is shown in the accompanying photograph alongside type 10 which is a normal type with ascending pods.



Type 4114 Type 10

Description of type 4114.—Tall, hairy, late, leaves deep-green and dull, flowers large, petals lemon-yellow, pods long, pendant flat, two-valved, broad and beaded, seed smooth, yellow, bold.

Govt. Research Farm, Cawnpore, *April* 8, 1946.

T. S. SABNIS.
T. R. MEHTA.

1. Sabnis, T. S., and Phatak, M. G., "A preliminary note on the classification of cultivated Indian mustards" *Ind. Jour. Agr. Sci.*, 1935 **5**, 559-78.

SOME NEW HOSTS OF *SCLEROTINIA SCLEROTIORUM* (LIB.) DE BARY

Sclerotinia sclerotiorum (Lib.) de Bary is known to attack many plants. Butler and Bisby (1931) have recorded the host plants of this fungus in India. Mundkur (1934) has given a comprehensive account of the taxonomy and parasitism of this fungus which caused a disease of *Hibiscus sabdariffa* Linn. He was also successful in producing the apothecial stage of the fungus in culture, which the previous workers in India had failed to obtain.

Eruca sativa Mill. is a common *rabi* season crop of the United Provinces, grown chiefly as an oil-seed crop. This year the crop grown at the College farm was very severely attacked and considerably damaged by *Sclerotinia sclerotiorum*. The crop was present as a mixture in an oat field and almost all the plants were badly affected. The disease was noted in the second week of February when the crop was in early stage of fruiting. The disease must have started much earlier as many plants, attacked near the ground-level, had fallen down and were devoid of fruits. The ground was littered with sclerotia and where the attack was particularly severe, there were as many as 78 sclerotia per square foot.

Observations showed that the disease did not start from any particular part of the plant. Patches of dead tissue were scattered throughout the stem, more particularly on the thinner branches. The roots were not affected.

Symptoms.—The affected patches are at first water-soaked in appearance but soon get covered with a weft of white and cottony mycelium. These patches elongate longitudinally and sometimes show distinct concentric zonation. Finally the stem is encircled and numerous sclerotia appear embedded in the mycelium. In the beginning these are white, gradually turning darker and drops of a clear liquid often ooze out from their surface. Internally the sclerotia are often pink coloured at this stage. The sclerotia ultimately become black (Plate I),

PLATE I. Symptoms caused by *Sclerotinia sclerotiorum* on *Brassica juncea*.

and generally fall down on the ground. The sclerotia, however, do not develop plentifully within the stem. The affected pods are similarly covered with superficial mycelium, there being no seed formation but mycelium and sclerotia are often present within the pods. The severely affected parts decompose and shred into fibres, leading to the collapse of the entire plant which falls down and gets covered with copious mycelium and sclerotia. The leaves arising from the infected patches droop down and are shed. The smaller sclerotia are usually round, and the bigger ones are flatter and loaf-shaped or irregular in shape. They measure from 2-12 mm., the average size being 6 mm.

The perfect stage of the fungus.—Although there was an enormous number of freshly fallen sclerotia in the field none of them showed any sign of apothecial development. It was therefore decided to make a thorough search in order to find out whether the sclerotia buried in the soil, from the previous years' crop or those formed earlier in the season, produced any apothecia. In moist patches a number of apothecia in various stages of development were found to arise from sclerotia buried in

PLATE 2. *Sclerotinia sclerotiorum:* Natural occurrence of apothecia in field.

the soil (Plate II). Their development was carefully studied.

Usually one or two cylindrical and flexuous stipes are produced from each buried sclerotium, but larger sclerotia sometimes produce as many as five fruiting stipes. The stipes are sometimes dichotomously branched within the soil, each branch being fertile. The length of the stipe varies from 25-88 mm.; the breadth is maximum at the base of the apothecium and is approximately 1 mm. in diameter, but lower down and especially at the point of origin it is much thinner. The exposed part of the stipe is fawn coloured but within the soil the colour is brown or dark-brown. The apothecial fundament is borne at the tip of the stipe as a minute brownish or fawn coloured funnel-shaped structure, just above the surface of the ground. The fundament, usually 1 mm. in diameter, expands into a shallow, flat or convex apothecium. The mature apothecia are 6-9 mm. across, cartridge-buff to pale ochraceous-salmon in colour turning cinnamon brown or Mars brown* when old, generally borne 6-10 mm. above the surface of the soil. Sometimes the exposed part of the stipe is branched, usually into two and rarely more than two subsidiary stipes, each bearing a smaller apothecium.

A number of apothecia were teased out and examined under the microscope. The length of the asci varied from 108-153 μ, with an average of 122·9 μ. The breadth from 4·5-8·1 μ, with an average of 5·9 μ. The length of the ascospore varied from 7·2-11·7 μ with an average of 8·9 μ, and the breadth from 3·6-5·4 μ with an average of 3·9 μ. As far as the authors are aware this is the first record in India of the natural occurrence of the apothecial stage of *Sclerotinia*.

Some stray plants of *Brassica juncea* present in the field were found to be affected (Plate I), but the percentage and the extent of damage was far less than in the case of *Eruca sativa*. This was probably due to the more woody nature of the stem of the former plant. The plants of *Eruca sativa* in this particular case were unusually herbaceous due to their being present as a mixture with oats.

A number of plants of *Coriander sativum* Linn. were found wilting in the College Botanical Gardens. There were hardly any symptoms to indicate the presence of *Sclerotinia;* but isolations from affected tissues near the ground-level invariably yielded a fungus culturally similar to *Sclerotinia sclerotiorum*.

As the size of the asci and ascospores differed from those given by Mundkur, the senior author obtained a culture of the fungus from the Imperial Agricultural Research Institute, New Delhi, and on comparison of cultural characters the isolates from *Eruca sativa*, *Brassica juncea* and *Coriander sativum* appeared similar to the type culture obtained from Delhi. Isolations from the ascospores from fresh apothecia gave identical cultures.

P. R. MEHTA.
BABU SINGH.
S. K. BOSE.

Botanical Section,
Govt. Agricultural College,
Cawnpore,
April 30, 1946.

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* Ridgway, R., *Colour Standards and Colour Nomenclature.*

REVIEWS

Vitamins and Hormones, Vol. II. Edited by Robert S. Harris and Kenneth V. Thimann. (Academic Press Inc., New York), 1944. Pp. xv + 514. Price $5.00.

Introducing the series under reference, Prof. McCollum wrote: "The time is ripe for the founding of such a venture since it is no longer possible for any one to read sufficient of the current papers and library files dealing with these two classes of substances to assimilate all the knowledge which has accumulated. We must increasingly depend upon our colleagues, who maintain mastery of specialised experimentation to appraise for us the numerous contributions which they alone can interpret, sifting error from truth and assembling scattered data to make a connected account which places a body of related facts in proper perspective. This is the function of the new publication."

The second volume of the series under review fulfils the function as envisaged by Professor McCollum; the volume includes a wide range of topics covering the physical, chemical, physiological and clinical aspects of some of the important vitamins and hormones. Eleven topics have been discussed in the present volume: (1) Vitamins in the anabolism of fats; (2) Chemistry of biotin; (3) Nutritional requirements of primates other than man; (4) Physiological action of vitamin E and its analogues; (5) Chemistry and physiology of vitamin A; (6) Para-amino benzoic acid—Experimental and clincal studies; (7) A critique of the etiology of dental caries; (8) Vitamins and cancer; (9) Effect of Androgens and Estrogens on birds; (10) Hormones in cancer; and (11) X-ray crystallography and steroid structure.

Of special interest to those interested in problems of cancer, one of the deadliest curses on humanity, are the two chapters on cancer in relation to vitamins and hormones. One of them (Vitamins and Cancer) constitutes an inspiring presentation of the intricate problem, which is full of attractive suggestions for future investigators.

A perusal of topics listed above show the wide and varied appeal and interest which they are bound to elicit. The series, of which the present volume forms a part will be enthusiastically welcomed by all investigators interested in the pure and applied aspects of vitamins and hormones. The publishers deserve to be congratulated on their enterprise in filling so admirably the void created by the disappearance of "Ergebnisse der Vitamin und Hormon-Forschung".

Radar. By Major R. W. Hallows. (Chapman and Hall, London, W.C. 2), 1946. Pp. 140. 7*sh.* 6*d.* net.

In 1925 Breit and Tuve of Carnegie Institution of Washington successfully used the pulse method for determining the height of the ionosphere and since then, every worker in the field of radio communication in every part of the world was aware of the Radar as a possibility of the near future. The threat of war intensified the work in this direction during the thirties in all countries. The credit of developing a practical and rugged form of it for the first time goes to Sir Edward Appleton and Sir Robert Watson-Watt, two brilliant products of the Cavendish Laboratory. And now, the credit for writing the most popular and lucid account of the Radar goes to yet another Cambridge man, the author of the book under review!

The first official release on the Radar was a report by the Joint Board of Information Policy of the Scientific Research and Development, War and Navy Departments of the U.S.A., in August 1945. This has been followed by articles and reports in technical and non-technical journals which are not of great use to the man-in-the-street. The book under review supplies this great want.

Any man or woman with an average amount of commonsense and intelligence can read through the book like a novel. It is the outcome of the author's experience as a chief instructor in the Fire Control (Radar), 6th anti-aircraft group school in Britain. In the foreword to the book, General Sir F. A. Pile, Commander-in-Chief of the A. A. Command, 1939-46, rightly observes that "the author has the gift of making extremely difficult and obtruse things appear simple and even obvious". The function of the Radar, the principle of reflection, the speed of light, the idea of small intervals of time like micro-seconds, an electron beam as an inertialess relay, the cathode-ray oscillograph, etc., are all most lucidly and elegantly explained in successive chapters and this is followed by actual descriptions of the Radar. A welcome feature of the book are the beautiful Crown copyright photographs of the British Radars, etc.

The printing and get-up of the book are excellent and there are numerous good figures drawn to explain the principles enunciated in the body of the text.

Radar is one of the greatest inventions of the war and its possible uses in peace are immense. No man, woman or child can afford to be ignorant of its basic principles, and here is a book most eminently suited for the purpose. It needs no recommendation. The reviewer is certain that every school, college, private and public library shall go in for a copy of the book. The book has its utility to the technical man also. It provides a most beautiful introduction.

S. V. CHANDRASEKHAR AIYA.

The Cavendish Laboratory. By Alexander Wood. (Cambridge University Press), 1946. Pp. 60. 8 Plates. Price 2/6.

The establishment of the Cavendish Laboratory in Cambridge in 1874 may truly be said to have marked the beginning of the most glorious chapter in the progress of scientific

research in Great Britain—ushering in the era of modern physics. In the domain of physics, the Cavendish Laboratory has been intimately associated with the most notable personalities and almost all the epoch-making discoveries. Therefore the stupendity of the task involved in condensing the entire history of the Cavendish Laboratory into few pages of a booklet may be well understood. Dr. Wood has achieved this to a commendable extent in this booklet of 60 pages. A survey of the most important events and anecdotes connected with the Cavendish Laboratory starting from the quiet beginnings under the professorship of Clerk Maxwell in 1875, followed by Lord Rayleigh and then by "the man who split the atom", namely, J. J. Thomson, has been made in the first forty pages. The remaining twenty pages are devoted to a brief summary of the most important events that took place under the leadership of Lord Rutherford, "the alchemist", and his successor, Sir Lawrence Bragg. The book presents an interesting and instructive pen-picture of the world-famous laboratory.

R. S. K.

India—Part I. Physical Basis of Geography of India. By H. L. Chhibber. (Nand Kishore & Bros., Benares), 1945. Pp. xix + 282, with 10 plates and 19 text-figures and maps. Price Rs. 5.

Books on the physical geography of India are rare and, therefore, the publication of this work by Dr. Chhibber is to be welcomed. The book is divided into twenty chapters and deals with the physical divisions of India, mountains, plateaus, rivers, lakes, glaciers, earthquakes, coast lines, volcanoes, hot springs and mineral waters, climate and climatic regions of India, weathering and denudation, geology, soils and soil erosion, fertilisers and manures, and the structure of India. An alphabetical index at the end adds to the value of the book.

There is some confusion as regards the title of the book. On the back of the cover the book is entitled "Physical Basis of Geography of India—Part I", whereas on the first page of the cover as well as inside it is printed as "India—Part I. Physical Basis of Geography of India". The two do not mean the same.

On page 173, the Dharwars are stated to occur in narrow elongated synclines *resting* on the gneiss. Again on page 189, the Dharwar rocks are supposed to have been derived from the denudation of the Archæan gneisses. This is not correct as the Dharwars in most of the areas in India are now considered as the oldest rock formations into which the later gneisses have intruded, except perhaps in Rajputana where the gneisses are regarded as older than the Aravallis.

Mer de glace is only one of the Alpine glaciers and not a collective name for the glaciers of the Alps as suggested on page 79. The name is misspelt both in the text and in the index.

This book is unfortunately marred by numerous printing errors. The first person to use the term "Laterite" was not Buchman as stated on page 210 but Buchanan. "Quaternary" has been consistently misspelt, twice on page 170, and again in the index.

Geologists and geographers will find in this book a useful collection of material on the physical geography of India.

C. S. P.

Annual Review of Biochemical and Allied Research in India, Vol. XIV. (Society of Biological Chemists, India, Bangalore), 1943. Pp. 142. Price Rs. 3 or 6 *sh.*

The *Annual Review* was published in 1945 with a note of apology for the inordinate delay caused by 'unforeseen circumstances'. Except for the delay, these 'circumstances' seem to have had no adverse effect on either the contents or the general make-up of the *Review* itself. The investigations in the field of Biochemistry and related branches of science, reported during the year, have been reviewed in an exhaustive manner under twelve chapters. A regrettable feature, however, noticed in the chapter on Industrial Mycology, is the replication of the previous years' reviews, though presented in a slightly different guise. If found absolutely necessary, a mere reference to the previous years' reviews would have been sufficient. Instead, one finds the same work described at length once again. A repetition of this sort is apt to frustrate the very purpose of an 'annual' review and, therefore, needs to be eliminated. An index of the periodicals from which matter is collected for the *Review* would be a vaulable addition to the existing regular features.

S. R. Aswatha Narayana Rao.

WAR-TIME ADVANCES IN PHYSIOLOGY

Annual Review of Physiology, Vol. VII. By James M. Luck and Victor E. Hall. (American Physiology Society and Annual Reviews Inc., Stanford University, P.O. California.) Pp. vii + 774. Price $5.00.

THE seventh volume of these *Annual Reviews* which have practically grown during the war years, is the largest yet published; the volume has been published on the eve of the approaching end of the world conflict. During the preceding difficult and anxious years, scientists have had to regiment themselves in the cause of applied research of vital importance to the prosecution of war. The belligerent governments during the war, extended their unstinted and lavish financial support to schemes of research, to a degree which has been unprecedented in the history of research; the operations of war, bloodier and more inhuman as they proved to be, have been responsible for raising many an urgent problem in human physiology, which would have been hardly thought of. Unprecedented opportunities and uncommon materials of research became abundantly available during the war. Physiological research was most intensively

perused, more particularly in its applied aspects. Much of this work which had to be maintained as a closely guarded secret on grounds of security, is expected to be reviewed in these *Annual Reviews* during the coming post-war years.

Researches in the domain of physiology as reflected in the volume under review are naturally dominated by a strong bias towards the critical exigencies of war. The combating personnel associated with the three services—land, sea and air,—had to be subjected during their fighting operations, to extreme degrees of stress and strain, which had never been attained during any of the previous wars. The maintenance of the highest degree of occupational fitness among men and women on every front was essential for winning the war. The human organism experienced new heights of endurance and achievement; these experiences are contributions to physiology which would never have been made but for the war.

The *Review* follows the general plan of its predecessors; it contains twenty-six contributions. The advances in the fundamental aspects of physiology, *e.g.*, permeability, physical properties of protoplasm, physiological aspects of radiant energy, physiological aspects of genetics, development physiology, are each reviewed in the chapter bearing the title. Water metabolism attained special significance, thanks to "the necessities of war waged on a global scale" and the literature pertaining to this problem which has developed to an unusual degree, has been reviewed. The disturbance in fluid balance, incidental to extensive burns, severe hæmorrhages, traumatic shocks, water and salt deprivations and exposure to extremes of environment, have received special attention. The physiological effects of heat and cold form the topic of an interesting review; much of the stimulus for investigation of the human response to cold has been provided by the pressing need "for data on the physiological changes resulting from prolonged exposure such as occurs in life-boats in northern oceans, men fighting in semi-arctic terrain and aviators who have made forced landings in the snow". Among other chapters of general interest are those entitled, Exercise, Physiological Psychology and Applied Physiology. The volume is well documented with author and subject indices and contains 4,348 references to literature. These *Annual Reviews*, in the coming years, will undoubtedly acquire an even greater degree of usefulness to all interested in the pure and applied aspects of physiology.

SCIENCE NOTES AND NEWS

Chromosomes in *Butomopsis lanceolata*.—Mr. Y. Sundar Rao (Mrs. A. V. N. College, Vizagapatam) records the chromosome number in *Butomopsis lanceolata* Kunth., a member of Butomaceæ. The haploid number is 7 and the bivalents from variable number of chiasmata, the number being proportional to the length of chromosomes. There are two long pairs and others vary in length. A study of meiosis and mitosis will be published elsewhere.

Deputation of Eminent Indian Scientists.—Following the successful tour of the Indian Scientists to the U.K. and the U.S.A. in the latter half of 1944, it was decided that batches of eminent Indian scientists who were studying important problems either directly concerned with matters of national importance or connected with such matters should go abroad, not on a peripatetic tour but for special study in their respective subjects over a period of about six months. It was felt that such visits would enable the scientists to acquire valuable experience in modern development which would greatly benefit the country on their return. It was also felt that once such contacts had been made, it would become much easier for Indian scientists to go abroad with the assurance that they would meet leading men of science and, under their guidance, be put in touch with the appropriate research institutions.

Under this scheme it is proposed to send the following scientists to the U.K. and U.S.A. in the first batch.—

(1) Dr. M. R. Siddiqi, M.A., Ph.D., D.Sc., F.N.I., Director of the Research Institute, Osmania University, Hyderabad.
(2) Dr. K. S. Krishnan, D.Sc., F.R.S., Professor of Physics, Allahabad University.
(3) Dr. H. J. Bhabha, F.R.S., Director, Tata Institute of Fundamental Research, Bombay.
(4) Dr. K. N. Bahl, Professor of Zoology, Lucknow University.

Dr. Siddiqi and Dr. Krishnan have already left for the U.K. More recently, Dr. Bhabha has reached England. These three scientists are also among the Indian delegates to the Royal Society's Empire Scientific Conference which commenced its session in London on the 17th June 1946.

SARDAR BAHADUR SIR DATAR SINGH.—Datar Singh, Sardar Bahadur, Sir, Fellow of the Royal Society of Art, London, Cattle Utilisation Adviser to the Government of India. Sardar Bahadur 1937; Kt. Cr. 1939; Member, Imperial Council of Agricultural Research of India since 1933. After completing his studies in India, he went to England in 1919 and returned to India in 1921 after specializing in Dairying and started an up-to-date Dairy Farm in India; represented India at the International Dairy Conference, Copenhagen, in 1931 and Berlin 1937. Examiner of the All-India Dairy Diploma since 1935; Non-Official

Adviser to the Government of India for the Trade Negotiations between H.M. Government in U.K. and Government of India and was sent to England in 1937 on this duty; served as Non-Official Adviser to Government of India in Indo-Japanese Trade Negotiations; has been a Member of the Central Board of Interview of Emergency Commissions in India; Member of the Central Food Advisory Council; Member of the General Policy Committee; Member of the Export Advisory Council; led Indian Industrial Delegation to Australia and New Zealand, 1945. Has taken keen interest in Animal Husbandry problems of India.

Since taking over charge as Cattle Utilisation Adviser in August 1944, he has been organising the *Gowshalas* and Pinjrapoles in India to work on improved lines, so that instead of their being asylum for old and infirm animals, they should also increase the milk production and improve the cattle breeding. For this, his schemes have been sanctioned in most of the provinces. He has been helping in the organisation of salvage of dry cattle and also in the enforcement of the restrictions on the slaughter of useful cattle in the provinces.

SIR HERBERT STEWART, C.I.E., I.A.S., Vice-Chairman of the Imperial Council of Agricultural Research, and President of the Indian Central Jute Committee, having gone on four months' leave, Sardar Bahadur Sir Datar Singh, Joint Vice-Chairman, Imperial Council of Agricultural Research, has taken over charge recently as President of the Indian Central Jute Committee and Vice-Chairman of the Imperial Council of Agricultural Research.

RAI BAHADUR G. C. SEN, Deputy Secretary to the Government of India, Department of Agriculture, has been appointed Secretary of the Indian Central Jute Committee. He took over charge on the 3rd June from Mr. C. R. Nodder, the acting Secretary, who has reverted to his substantive post of Director of the Technological Research Laboratories of the Committee at Tollygunge from the same day.

It is understood that MR. K. RAMIAH, Director-designate of the Rice Research Station, who was entrusted with the task of selecting a suitable site for the location of the Station, has recommended Bidhyadharpur, Orissa, for serious consideration.

Central State Scholarships.—The practice of the Government of India of awarding one Central State Scholarship annually for study in Great Britain, which had to be discontinued during the period of the war, has now been revived. No awards were made during the last four years. For the year 1946-47, three scholarships have been awarded to the following candidates:—(1) Miss Musarrat Jahan Begum Temuri of Delhi, (2) Mr. Raghu Raj Bahadur of Delhi and (3) Mr. Girdhari Lal Gupta of Ajmer-Merwara.

The Joykissen Mookerjee Gold Medal for 1944, and the **H. K. Sen Memorial Medal** for 1946, have both been awarded to Sir Shanti Swarup Bhatnagar. The former is awarded annually by the Indian Association for the Cultivation of Science, for an eminent scientist whose association with the Institution is considered by the management to be in the best interests of scientific progress in India. The H. K. Sen Memorial Medal is awarded annually by the Institution of Chemists (India) to an eminent industrial chemist selected by the Council of the Institution.

SIR SHANTI SWARUP BHATNAGAR, O.B.E., D.Sc., F.R.S., has been elected a Fellow of the University College, London.

The Central Bureau of Education, Education Department, Government of India, is collecting information about educational, scientific and cultural organisations, as well as learned and research bodies in India. All such organisations are requested to supply up-to-date information about their constitution and activities to the Curator, Central Bureau of Education, Education Department, Government of India, New Delhi, by June 25.

Lady Tata Memorial Trust: *Scholarships and Grants for the year* 1946-47.—The Trustees of the Lady Tata Memorial Trust have just announced, on 18th June 1946, the death anniversary of Lady Tata awards of scholarships and grants for the year 1946-47.

The International awards for research in diseases of the blood with special reference to Leucæmias are made to Doctors Jorgen Bichel (Denmark), Pierre Cazal (France), Jal J. Dubash (India), Pierre Dustin (Belgium), Peter A. Gorer (South Africa), Maurice Guerin (France), Simon Iversen (Denmark), Werner Jacobson (England), Joseph Japa (Poland), Edith Paterson (England), Hall Schartum-Hansen (Norway) and Prof. Edoardo Storti (Italy).

Indian scholarships of Rs. 150 per month each for one year for scientific investigations having a bearing on the alleviation of human suffering are awarded to Messrs. L. D. Sanghvi (Bombay), T. A. Venkitasubramania (Ernakulam), G. Balasubramanyam (Bangalore), T. K. Wadhwani (Bangalore), Rabindra Kumar Basu (Calcutta), S. Swaminathan (Bangalore), Jagannath Ganguly (Bangalore), Bhagchandra Jain (Bangalore) and Miss Anne Kumari Paul (Bombay).

ERRATA

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Page 99, column 1, para 2, line 3 from bottom: *for* "a portion of 3 to 89", *read* "a proportion of 3 to 97."

Page 115, column 1, lines 15 and 16 from bottom: *After* "The Decimal and Colon Classifications (A Summary and a Comparison)", *insert* "By R. S. Parkhi."

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